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SURGERY, GYNECOLOGY AND OBSTETRICS

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A CONSIDERATION OF THE RELATIVE MERITS OF RESECTION AND GASTRO-ENTEROSTOMY IN THE TREATMENT OF GASTRIC AND DUODENAL ULCER[1]

BY PROFESSOR F. DEQUERVAIN, BERNE, SWITZERLAND
Professor of Surgery, University of Berne

THE question as to the relative merits of resection and gastro-enterostomy in the treatment of gastric and duodenal ulcers has not as yet been settled, as is evidenced by the papers presented at the recent medical and surgical congresses. The final decision as to which operation to perform lies with the surgeon, and to enable him to make such decision he must have practical experience involving a large number of cases observed over a period of several years. In order to learn the end-results in our clinic —a most important postulate—I have had our assistant surgeon, Dr. Wydler, study the ulcer cases which we have treated since 1910 (247 cases), and make repeated follow-up examinations of them. In this manner we hoped to help in solving certain diagnostic problems, in determining the general indications for operation, and finally in deciding upon the best technique to use in any particular case. Our own statistics differ from those of other operators in that we have made not only more frequent follow-up examinations of our cases but especially in that during the entire period of study we have done both gastro-enterostomies and resections so that we are in position to draw conclusions as to the results of the two operations. A complete report of the results of this study was published in the *Schweizerische medizinische Wochenschrift*, 1921, No. 25. In this paper, therefore, we shall present only the most important diagnostic points from the point of view of the practical surgeon and shall give the results of the different procedures as we find them.

INDICATIONS

We consider an operation indicated when stenosis or repeated bleeding is present and endangers the life of the patient or when persistent symptoms resist all efforts at medical treatment, and thus impair the efficiency and well-being of the patient. These limitations are mentioned because many ulcers heal spontaneously or with medical treatment, because in some cases, even after operation, the tendency to form ulcers still remains, because operation does not in all cases effect a cure, and because operation is accompanied by a certain risk and certain sequelæ may follow intervention, as for instance, ulcus pepticum jejuni.

Inasmuch as 70 per cent of the patients who come to us for treatment have suffered for from 5 to 30 years with gastric disturbances and a large proportion of the cases has been given systematic non-surgical treatment without improvement, we have

[1] Read before the Chicago Surgical Society, October, 1921.

adopted certain fundamental principles in dealing with them.

DIAGNOSIS

The following points which it is especially important that the clinician should know are presented.

The rôle of the hydrochloric acid. Too much importance is attached to the rôle played by hydrochloric acid. In reality, in gastric or duodenal ulcers, the percentage of cases showing hyperacidity is far less than the percentage showing normal or subnormal acidity. According to our statistics there is a hyperacidity in about two-fifths of the cases with gastric ulcer and in one-third of the cases with duodenal ulcer. Hyperacidity is, indeed, more frequently present in ulcer cases than in carcinoma cases, but this fact must not be used as a sign arguing against the presence of carcinoma when other findings point to carcinoma. In cases in which carcinoma is suspected, one should not wait for a change in acid reaction before turning the patient over to the surgeon. Gluzinsky, Kocher, and Fonio attach great importance to the increase in hydrochloric acid produced with test meals containing protein as compared with the test breakfast. We have tried this in 73 cases of ulcer and have found that the methods agreed 42 times and disagreed 31 times (including one case of carcinoma). Even if it is a contra-indication to carcinoma of the stomach (increase of hydrochloric acid with test meal), still this is by no means true in all cases. There are variations from the rule in both directions—there may be an increase of hydrochloric acid in carcinoma cases and conversely there may be a decrease in hydrochloric acid in benign ulcer cases.

Lactic acid. It was not possible to detect lactic acid in any case of ulcer which was found benign at operation. It has long been known that the lactic acid test, when positive, is of much greater significance than the hydrochloric acid test.

Occult blood in stools. While we seldom fail to find occult blood in carcinoma cases with the guaiac and benzidine tests, after 3 days of meat-free diet and other precautions including avoiding brushing the teeth, the test was positive in only 50 per cent of the gastric ulcers and 65 per cent of the duodenal ulcers.

Roentgen examinations. We will discuss but briefly tonight the rôle played by roentgen-ray examination in diagnosing gastric and duodenal ulcers. A complete account of our own experience at the Basle Clinic will be found in Stierlin's book. However, I would like to state that in gastric ulcer we have found exact localization possible by roentgen examination in 87 per cent of the cases and impossible in 13 per cent. In 100 cases of ulcer of the lesser curvature 72 showed definite niches. Generally speaking, in half the ulcers of the lesser curvature, there was a six-hour retention showing spastic retention. In duodenal ulcer localization was possible with the roentgenogram in 54 per cent of the cases. Definite niches were found four times. It was possible to make a definite diagnosis of ulcer of the lesser curvature and of the pylorus in most cases, while in ulcer of the duodenum diagnosis was possible only through the process of elimination. As the study of the forms of bulbus duodeni becomes more and more exact so will the diagnosis become more positive in character.

Regarding the dentations on the greater curvature, Dr. Stoccada has shown, with the material from our clinic, that these are more frequent in gastric and duodenal ulcer cases than in carcinoma cases, but that they may occur in cases of gastric carcinoma and also in cases with anatomically sound stomachs.

PATHOLOGICAL STATISTICS OF ULCER

In 6 per cent of the cases a positive differentiation between benign ulcers and carcinoma could not be made at operation and the diagnosis was possible only after histological examination. Carcinomatous degeneration of an originally benign ulcer could be demonstrated with certainty in 1.4 per cent of the cases. This number should represent only a lower limit. Multiple ulcers occurred in 9.3 per cent of the cases.

IMMEDIATE RESULTS OF OPERATION

The operative mortality after gastroenterostomy in our series is 6.5 per cent, that

after radical operation 7.7 per cent. In addition there are two late deaths after gastro-enterostomy, one from renewed bleeding from the ulcer, the other from perforation of an ulcus pepticum jejuni. These concern the operative mortality only indirectly but must be considered in making comparison with the statistics for resection. The relatively high operative mortality after gastro-enterostomy is dependent upon the facts that the stringent rules we have adopted in selecting cases for operation exclude the mild cases of ulcer and that moderately severe cases are often operated upon by resection, so that gastro-enterostomy has been done in a great number of bad cases.

The most important causes of death—and really three-fourths of the true postoperative deaths are due to lung complications—are emboli, pneumonia, and lung gangrene. The danger of these complications depends more on the extent of operation than on the question of anæsthesia. Even after local anæsthesia we have seen embolic processes and pneumonia. Perhaps there will always be an opportunity here to improve our method of procedure. The statistics from our clinic confirm the old conception that a good share of cases which suffer, following operations upon the stomach, with so-called pneumonia are in reality suffering from a process embolic in nature. In three cases the causes of death were, respectively, bleeding from the existing ulcer, a simple heart failure, and the failure of the suture to hold in a Billroth I operation.

In two cases we had to deal with what was formerly so much feared—a vicious circle—and in both cases we were fortunate in securing favorable results. In two cases there was a hard infiltration in the omentum and in the connective tissue of the mesentery but no acute inflammation. The entire region of the operation was changed to a compact cake. The symptoms in this condition may simulate those of vicious circle.

Ulcus pepticum jejuni was observed eight times in our own cases and twelve times in cases of primary operation done elsewhere. We do not doubt that this condition will be found more commonly the more often and carefully the patients are examined. This complication very commonly follows the von Eiselsberg pylorus-exclusion operation. The suture material used is a big factor in producing peptic ulcer. This observation prompted us to avoid using non-absorbable suture material. After experimenting with different materials in animal research work, we have decided to use fine catgut in suturing the mucosa and serosa re-enforcing these continuous sutures with cotton stitches. The stitches serve at the same time to close the opening in the mesentery. Since adopting this method (1917) we have observed only one case of ulcus pepticum.

LATE RESULTS

Cases which on repeated examination remain completely free of symptoms, also those who present only insignificant symptoms, are entered as cured; those in whom there is no improvement at all or only slight improvement or in whom manifest symptoms still remain, are entered as unimproved.

Because of the danger of peptic ulcer following operation and because of repeated bleeding from the primary ulcer, we have abandoned schematic gastro-enterostomy and lean more toward resection. I would summarize my results in the following statements.

1. That 90 per cent of ulcer recurrences, peptic ulcer and other disturbances, occur in the first 4 years after operation, so that statistics which depend on results reported earlier than 4 years after operation are apt to show too favorable results. Observations made in the first 4 years after operation do not contain all the possible sequelæ, and therefore later observations must be made in order to secure the final results.

2. That simple gastro-enterostomy produces in all forms of gastric ulcer about the same early results—somewhat more than four-fifths cure or improvement approximating cure.

3. That observations made over longer periods and including all cases show for gastroenterostomy for all types of gastric ulcer, a cure or improvement in 75 per cent of cases. In ulcers at a distance from the pylorus the average results are no less favorable than in those at the pylorus.

4. That the radical methods, irrespective of interval, show results similar to those in gastro-enterostomy at early periods, with a cure in about 80 per cent.

Let us compare the results of the different methods of operation. The so-called sleeve operation, transverse section, whether carried out on the fundus or near the pylorus gives very satisfactory results. The V-shaped excision is unsatisfactory. The end-results of the Reichel-Pólya operation—end-to-side anastomosis of the stomach to the upper jejunal loop with blind closure of the duodenum—are yet to be reported. Its possibilities should not be overlooked. Chemical analysis made after most of the operations showed a decrease in acidity, most marked after the Reichel-Pólya operation, less marked but still present in the majority after sleeve operation, and in varying manner after gastro-enterostomy. This decrease is often permanent but in some cases the acid production slowly returns to normal, indeed to hyperacidity. This latter holds true at least for gastro-enterostomy. In X-ray pictures we found after gastro-enterostomy in 6 cases a complete and in 2 cases a partial disappearance of Haudek's niche. We point to this observation with all reserve for it must be studied further. The reflex pylorospasm of ulcers of the lesser curvature disappears with the sleeve operation but may appear later if a recurrent ulcer forms.

As a result of the findings as stated, we believe we are justified in making the following statements as regards the value of the different procedures.

Even if we consider the fact that the rules which we have laid down in selecting cases for operation are very strict and that we have in general not operated upon mild early cases of ulcer, still we do not doubt but that with an increase in the number of cases operated upon by sleeve resection, the immediate operative prognosis will become less favorable. The operation requires more time and affords greater opportunity for the production of emboli and thrombi than does gastro-enterostomy. This is compensated for somewhat by the fact that after resection, there is no late bleeding from the ulcer with the resultant occasional death, and the danger from peptic ulcer is almost nil. Also as resection is used more the technique will be perfected and the results will improve accordingly.

In gastric ulcer in all locations we find that about the same end-results follow gastro-enterostomy as the radical method. However, in this connection let us leave out of consideration the V-shaped excision which has proved a bad method not only in our hands but also in the hands of others, and consider only sleeve resection. With this method we find a cure in 90 per cent of the cases. This is a result not obtained with gastro-enterostomy, indeed, even if compared only with the more favorable statistics as derived from tabulations made early after operation.

Similarly with duodenal ulcer, gastro-enterostomy yields 65 per cent cures with or without the von Eiselsberg exclusion, while in 9 cases operated upon by resection we find all remain cured. If properly executed, resection yields better end-results than gastro-enterostomy whether in a case of gastric or duodenal ulcer.

In these facts there lies a satisfactory reason for employing resection even though it involves somewhat greater operative risk. At this point we should state that this is true only when we do not hold ourselves to a fixed rule but rather are governed by the conditions which confront us. Among such conditions may be mentioned the location of the ulcer and the resistance of the patient; also the conditions under which the operation is to be carried out, for there are conditions independent of the patient under which it is better that the surgeon does not resect, even if resection can be done. We include here among other things technical experience and the type of assistants present. It is pleasant to be able to determine by statistics that one can with good conscience decide not to resect if these external conditions are not satisfactory. Regardless of the type of ulcer, one can do the patient a greater service by performing a good gastro-enterostomy than by doing a resection under unfavorable circumstances.

BENIGN TUMORS OF THE STOMACH

Report of Twenty-Seven Cases[1]

By GEORGE B. EUSTERMAN, M.D., Rochester, Minnesota
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Fellow in Section on Medicine, The Mayo Foundation

BENIGN new-growths of the stomach, which, because of their size or position, may cause disturbed gastric function are rare enough to be regarded as clinical curiosities. In fact the great preponderance of gastric cancers over benign tumors of the stomach largely explains why the latter receive scant consideration in the differential diagnosis of doubtful cases. A pre-operative diagnosis of benign gastric neoplasm is exceedingly difficult in the majority of cases, and has rarely been made at least until very recently. A great many of the cases reported in the literature have been found at necropsy and in the majority of those found at operation the true nature of the lesions had not been determined beforehand. In view of the importance of surgical conservation of such a useful organ as the stomach, the possibility that new-growth is benign takes on a very practical aspect. Of further clinical and diagnostic importance is the fact that these tumors may cause complications such as pyloric obstruction, intussusception of the stomach into the duodenum, recurring severe gastro-enteric hæmorrhage, strangulation, severe colic, malignant degeneration, and even perforation.

Two instructive reports on this subject have been presented before this association by the late Dr. Jesse Myer, and by Basch. For additional general reviews of the literature on the subject including excellent case reports and complete bibliographies, I would recommend the articles by Campbell, Merrill, Outland and Clendening. Reports concerning specific portions of this material already have been published by two of my colleagues, Balfour and Lemon, and by Nadeau and MacCarty in a pathological abstract.

The material, comprising 27 cases, all verified at operation, is composed of ten myomata, five fibromata, four angiomata, two dermoids, one gastric polyposis, two adenomata, and three polypis. Their histological subdivisions will appear in the more detailed consideration of each group. These cases fall easily and logically into clinical classifications, a primary and a secondary; in the former group it was the presence of the tumor itself which caused the symptoms justifying surgical interference, while in the latter it was an associated or accidental finding during the course of an operation for other obviously major disease. A brief résumé of the entire series appears in Table I.

The 27 patients in the series were under observation in the Mayo clinic between the years 1907 and 1921. During this period operation had been performed on 2,146 patients with cancer of the stomach, on 20 with sarcoma, and on 2 with malignant polyps of the stomach, a total of 2,168. The proportion, therefore, of malignant new-growths to benign new-growths is as 78 to 1, or 1.3 per cent of all gastric tumors were benign. But this proportion, in our experience, is only relative, for during the same period 2,285 additional cases of malignant gastric neoplasms, the majority of them inoperable, passed through the clinic.

Myomata. This group, of ten cases, has been histologically subdivided into three leiomyomata, three adenoleiomyomata, and four fibromyomata. The three leiomyomata were classified clinically, primary. Two of the patients (Cases 19940 and 206857) were men aged 66 and 44 respectively. Both had a marked myomatous hypertrophy involving more or less of the entire pyloric ring and presenting a palpable tumor, the first one 6 centimeters by 3 centimeters in size. Both patients had distressing gastric disturbances

[1]Presented before the American Gastro-Enterological Association, Boston, June, 1921.

TABLE I.—BENIGN TUMORS OF THE STOMACH

Case	Sex	Age	Lesion	A. Location; B. Size	Clinical Features
*19940	M	66	Leiomyoma	A. Two-thirds of pyloric ring B. 5 cm. by 7 cm.	Gastric disturbances, irregular type; indefinite colic pains; later ulcer type; palpable mass in epigastrium; hyperacidity, gastric retention
*44684	M	45	Leiomyoma	A. Antrum, near pylorus, cardia and œsophagus, jejunal B. 0.5 cm. to 2 cm	Recurring melæna, occasional diarrhœa; dysphagia Anæmia; diagnosed asymptomatic bleeding ulcer Gastric analysis not made
*206857	M	40	Leiomyoma	A. Pyloric ring B. Well-marked muscle tumor	In many respects had a duodenal ulcer syndrome Hyperacidity and hypersecretion
891	M	62	Adenoleiomyoma	A. Greater curvature just above pylorus. B. 1.5 cm. in diameter	Large ulcer on the lesser curvature with crater
77451	F	60	Adenoleiomyoma	A. Anterior wall of greater curvature 5 cm. from pylorus B. 1 cm. by 2.5 cm.	Cholecystectomy; appendectomy
209971	F	28	Adenoleiomyoma	A. Lower anterior wall B. 1.5 cm. by 2 cm.	Gastric neurosis
*40886	M	48	Fibromyoma	A. Posterior wall B. 6 cm. by 8 cm.	Three-year-ulcer type of complaint; melæna High normal gastric acidity; obstruction; tumor
*142665	F	65	Fibromyoma	A. 7.5 cm. above pylorus; posterior middle wall B. 5 cm. by 7 cm.	Chronic painful epigastric complaint; achylia; secondary anæmia Movable, nodular tumor in left epigastrium. Intussusception tumor with posterior gastric wall into duodenum (Fig. 2)
*236057	F	35	Fibromyoma	A. Anterior wall 3.5 cm. above pylorus and close to greater curvature B. 2 cm. by 1 cm.	Gastric disturbances of 3 months' duration Severe attacks of pain. Tumor near pylorus "ball valve." X-ray: Filling defect in pylorus with large six-hour retention Normal acidity (Fig. 1)
334803	F	61	Fibromyoma	A. Anterior wall B. 2.5 cm. in diameter	Pelvic inflammation; chronic cholelithiasis Diabetes mellitus
*53373	F	40	Fibroma	A. Submucosa; pylorus B. 3.5 cm. by 2.5 cm.	Indefinite dyspepsia for 2 years, continuous for last 5 months. Discomfort one-half hour after meals; emesis gave relief; subacidity; mobile tumor
*86627	M	36	Fibroma	A. Pylorus B. 8 cm. by 5 cm.	History similar to that of duodenal ulcer of 4 years' duration Hyperacidity; occult blood in fæces
*208743	F	16	Fibroma	A. Pylorus B. 3 cm. by 2.5 cm. by 2.5 cm.	Ulcer type of complaint and associated with duodenal ulcer; secondary anæmia. Palpable mass in the right epigastrium. Prepyloric filling defect (Fig. 3)
241305	F	51	Fibroma	A. Not stated B. Pedunculated; 7 mm. by 2 mm.	Duodenal ulcer
*313898	M	66	Fibroma	A. Anterior wall B. 1.5 cm.	Associated carcinoma of cæcum; gastric history symptomless X-ray showed lesion at outlet; moderate 6-hour retention (Fig. 4)
*258233	M	67	Hæmangioma	A. Anterior wall; body of stomach B. 6 cm. by 5 cm. by 5 cm.	Complaint 6 months' duration; diarrhœa, melæna; 2 months' indefinite aching in left costal margin; 2 weeks' indefinite pain in the right costal margin; sense of fullness with discomfort; appetite good; weight loss 25 pounds; free hydrochloric acid (Figs. 5 and 6)
*324147	F	25	Hæmangioma	A. Midway on greater curvature B. 2.5 cm. by 2.5 cm. by 2 cm.	A typical history; hæmatemesis, melæna, and diarrhœa Anæmia; normal gastric chemism; ulcer crater in apex of tumor Lesions in posterior wall and greater curvature (Fig. 7)
*343572	M	50	Hæmangioma	A. Anterior wall—bologna shape B. 11 cm. by 3 cm. by 2.5 cm.	Dyspnœa, weakness, severe anæmia; no gross bleeding Occasional emesis and sense of fullness after meals Ulcer area 3 cm. by 5 cm. on tip of tumor (Figs. 8 and 9)
*356641	F	22	Hæmangioma	A. Duodenopyloric B. 7 cm. by 5 cm.	Dyspepsia since childhood, provoked by indiscretion; nausea and headache 2 to 3 hours after meals, sour emesis and relief; prevented by using soda before and after meals. Two acute attacks of epigastric pain 6 weeks prior to admission (Figs. 10 and 11)
*Pl6206	M	31	Dermoid	A. Posterior wall B. 7 cm. by 6 cm by 5 cm.	Recurring hæmatemesis and melæna; weakness; anæmia (hæmoglobin 40 per cent); no dyspepsia; free hydrochloric acid present
*136147	M	8	Dermoid	A. Posterior wall B. 1,000 gm.	Upper abdominal tumor of gradual growth, 4 years' duration; increased markedly in size in last 6 months; urinary frequency (Figs. 12 and 13)
*250518	M	31	Polyposis	A. Entire lower two-thirds of stomach	Indigestion for 8 years; ulcer type of complaint continuous for past year; no nausea or vomiting; occasional diarrhœa; no hæmorrhage; loss of weight; achylia; mucus; characteristic X-ray findings (Figs. 14, 15, and 16)
237007	F	27	Adenoma (Brunnerian)	A. 1 cm. above pylorus B. 2.5 cm. by 1.5 cm.	Gall-bladder disease
2206	F	30	Adenoma	A. Lesser curvature 5 cm. above pylorus	Gastric neurosis; chronic appendicitis
80723	F	29	Polypus (adenoma)	A. Near the pylorus B. "Small"	Gastric resection for hypertrophy of the pylorus
220699	F	20	Polypus (multiple papillomata)	A. Throughout stomach and jejunum B. 5 mm. to 3 cm.	Duodenal ulcer; second operation later for resection of jejunum
343402	F	38	Polypus (adenoma)	A. Posterior wall 7 cm. to 10 cm. above pylorus B. 11 mm. by 8 mm.	Gall-bladder disease; migraine; anæmia; healed tuberculosis at both apices

*Primary cause for operation.

Fig. 1

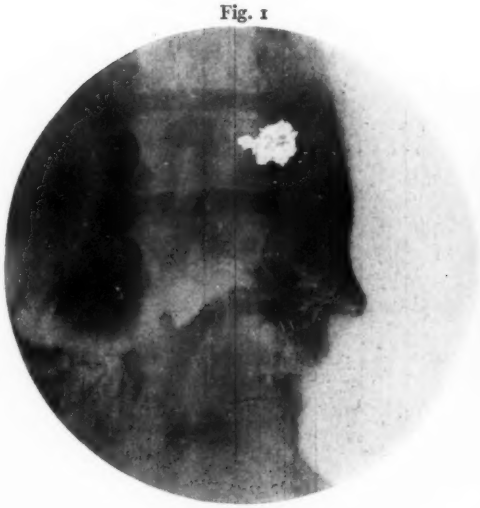

Fig. 2

Fig. 3

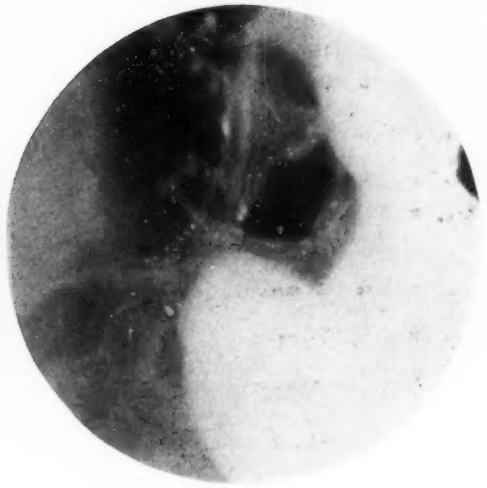

Fig. 4

Fig. 1. Filling defect in the pylorus with a large 6-hour retention. Small fibromyoma on the interior wall above the pylorus, close to the greater curvature.

Fig. 2. Unusual filling defect. Intussusception of the tumor with the posterior gastric wall into the duodenum.

Fig. 3. Prepyloric filling defect. Fibroma at the pylorus. Six-hour barium retention.

Fig. 4. Lesion at the outlet; moderate 6-hour retention. Small fibroma of the anterior wall and pylorus.

over a long period in many respects simulating chronic ulcer. Hyperacidity and gross retention were present in the gastric contents of the former, and hyperacidity and hypersecretion in the latter. The third patient (Case 44684) was a male, aged 45, with symptoms extending over a period of 5 years. The tumors were mural and multiple in the jejunum and œsophagus ranging in size from 0.5 centimeter to 2 centimeters, with one of medium size in the pyloric antrum. This case was characterized by recurring melæna, occasional diarrhœa, dysphagia, and anæmia, but an entire absence of dyspepsia.

The three adenoleiomyomata ranged in size from 1 centimeter to 2 centimeters, two were juxtapyloric on the greater curvature, the third on the anterior wall in the first portion of the antrum. Two were found during the course of an operation for ulcer or gall-bladder disease.

The four fibromyomata are of considerable clinical importance since three of them were primary, the patient seeking relief from them. The first patient was a man aged 48, with a movable tumor above and to the right of the navel. His dyspepsia was of 3 years' duration, strongly simulating ulcer. Gastric analysis revealed moderate hyperacidity and food retention. At operation a fibromyoma 7 centimeters in diameter on the posterior wall, was removed. The second patient, a woman aged 35, had had gastric complaint of 3 months' duration. The pain was usually severe. Gastric analysis and physical examination revealed normal conditions, but a filling defect of the pylorus, and a large barium residue was evident in the roentgenogram (Fig. 1). At operation a small tumor 2 centimeters by 1 centimeter was found on the anterior wall 4 centimeters above the pylorus, close to the greater curvature. While the tumor was not pedunculated it could be manipulated as a ball-valve, which probably explains the course of the painful seizures. The case of the third patient, a woman aged 65, is one of the most interesting in the series. She had had distressing dyspepsia for 6 years, progressive in character, with intermittent periods of food retention provoking emesis, and a palpable, movable, slowly growing mass in the left epigastrium of 4 years' duration. She had lost more than 60 pounds in weight during the 2 years preceding her examination. For 6 weeks immediately prior to her admittance, the patient had daily complained of irregular pains, of watery regurgitation and distress throughout the lower chest when swallowing and when regurgitating. Achylia and mucus were found on repeated gastric analysis, and a very unusual filling defect was revealed by the roentgenogram (Fig. 2). She had secondary anæmia. At operation (C. H. Mayo) a fibromyoma 5 centimeters in diameter was found on the posterior middle wall of the stomach 7.5 centimeters above the pylorus. The tumor, dragging with it the posterior wall of the stomach, had invaginated through the pylorus into the duodenum, a total distance of 12.5 centimeters, forming an intussusception of a portion of the stomach into the duodenum. Wade and Collier have reported similar complications in benign new-growths. In addition to these the museum contains three specimens of fair-sized myomata which have undergone sarcomatous degeneration.

Fibromata. The five tumors in this group occurred in patients ranging in age from 16 to 66. In one case, that of a small pedunculated fibroma, 7 millimeters by 2 millimeters, associated with a duodenal ulcer, the surgical records did not state the location, but the location in the remainder which were sessile, was definitely pyloric. According to the literature, this situation is the rule, although our specimens neither showed malignant changes nor represented fibrous growths at the site of old ulcers. Tumors varied in size from that of the smallest, already mentioned, to a diameter of 2.5 centimeters. Because of the position of the growth the roentgenogram revealed a filling defect in the pylorus and six-hour barium retentions (Figs. 3 and 4, Cases 208743 and 313898). In one patient (Case 53373), a woman aged 40, symptoms of 2 years' standing, continuous and progressively more marked for the last 5 months, in conjunction with anacidity, retained food masses, palpable tumor, and a pyloric filling defect, certainly justified the diagnosis of gastric cancer. In the second case a fibroma, measuring 8 centimeters by 5 millimeters which involved the pyloric ring, presented a syndrome characteristic of duodenal ulcer of 4 years' standing with hyperacidity. A pylorectomy in this instance resulted in complete cure.

Angiomata. The four tumors of this group are histologically hæmangiomata. They are exceedingly interesting because of their size and rarity. Lemon reported the first one of the series in 1920 and up to that time only five others had been reported in the literature. Two of our patients, both women, were in the second decade of life, one in the fifth, and one

Fig. 5

Fig. 6

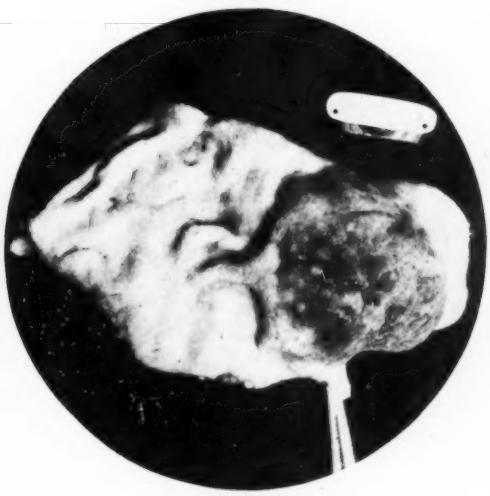

Fig. 7

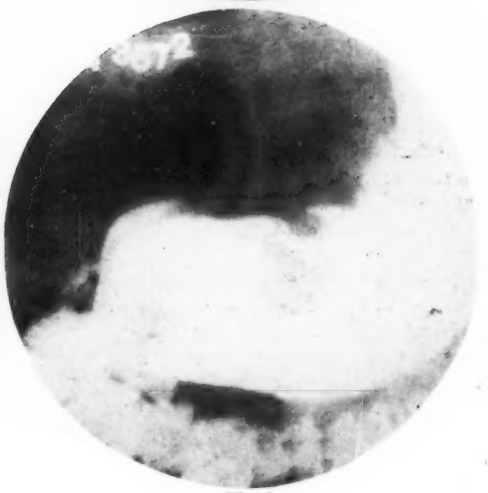

Fig. 8

Fig. 5. Large filling defect of the pars media and the anterior wall. Angioma of the stomach (6 by 5 by 5 centimeters).

Fig. 6. Angioma of the stomach as it presented on the mucous surface.

Fig. 7. Filling defect on the posterior wall and greater curvature. Angioma on the greater curvature (2.5 by 2.5 by 2 centimeters).

Fig. 8. Roentgenogram of tumor of the anterior wall of the stomach.

in the sixth decade. With one exception free hydrochloric acid was present in normal amount, and motility in all was unimpaired. With one exception the tumors were round, sessile, quite mobile at operation, of fair size, but not palpable on abdominal examination. They lay between the mucosa and serosa, were of soft consistency, and bluish black, or red; the one heretofore reported, situated in the fundus and anterior wall, suggested on palpation a mass of angle worms and the cut section resembled lung tissue (Figs. 5 and 6). In the second case the rounded pedunculated growth 2.5 centimeters by 2.5 centimeters by

Fig. 9. Sausage-shaped tumor (11 by 3 by 2.5 centimeters).

2 centimeters, was attached midway to the greater curvature and posterior wall (Fig. 7). The ulcer crater in the apex of the tumor explained the bleeding and anæmia. In the third instance an unusual bologna-shaped tumor, measuring 11 centimeters by 3 centimeters by 2.5 centimeters, situated in the anterior wall was found. Dyspnœa and weakness were the complaints presented, but on closer questioning an occasional sense of fullness after meals and emesis were revealed. The patient, a man aged 50, was very anæmic (hæmoglobin 44 per cent), gastric analysis showed an absence of free hydrochloric acid, a considerable number of fresh red blood cells and bits of tissue in the lower power field. These features, with the filling defect in the roentgenograms (Figs. 8 and 9), strongly suggested cancer, and this was made the provisional clinical diagnosis. The fæces contained besides the blood, pathogenic amœba and flagellatæ. The latter had probably provoked the diarrhœa. Erosion was found in the tip of the growth.[1] The last case, the only one of its kind to my knowledge, illustrates the diagnostic value of routine roentgen-ray examination in all doubtful or obscure cases. The patient, a woman aged 22, was of a nervous temperament, and had had dyspepsia since childhood, which was characterized by nausea and marked frontal headache, occasionally extending to the occiput, usually appearing 2 or 3 hours after a meal, and terminating in an hour or two by vomiting of sour gastric contents, followed by complete relief. These attacks were brief and intermittent, were often provoked by dietetic indiscretions, and in later years were prevented by small amounts of soda before and after meals. Up to within 6 weeks before her examination epigastric distress or pain had been absent, but since that time she had experienced two violent attacks of pain in the epigastrium about 4 hours after a meal, preceded by the usual dyspeptic symptoms and terminating in emesis with relief. The patient attributed these seizures to excitement of moving in the first instance, and in the second to the hasty preparation for a trip. The physical examination was practically negative, except for moderate anæmia, which was attributed to a severe menorrhagia present since the onset of menstruation at 14. She was 12 pounds below normal weight. Gastric analysis revealed normal acid values with hypersecretion. The roentgenogram revealed a large rounded, mobile mass in a dilated duodenum, which was diagnosed benign tumor (Figs. 10 and 11). At operation (E. S. Judd) a rounded sessile mass just without the pyloric ring about 7 centimeters by 5 centimeters, covered by a thin mucosa, was easily removed. It had the gross appearance and feel of œdematous myoma, but on section and microscopic examination it proved to be a hæmangioma. The patient is having

[1] A detailed description of the above four cases of hæmangioma will appear in a paper by Dr. Judd.

an uneventful convalescence. The painful seizures can best be explained by a temporary occlusion of the pylorus by the tumor.

Dermoids. So far as I know only a few of these cases have been reported. Our first patient, a man aged 31, was one of the earliest cases in the clinic. For 4 years he had had recurring attacks of hæmatemesis and melæna, finally causing severe anæmia and weakness. Free hydrochloric acid was present (hæmoglobin 40 per cent). A tentative diagnosis of asymptomatic, bleeding peptic ulcer was made. Operation revealed a rounded tumor of the posterior wall of the stomach 7 centimeters by 6 centimeters by 5 centimeters. This was diagnosed dermoid by the pathologist. The second patient was a boy aged 8. About 4 years previously his parents had noticed a small lump in his abdomen, which seemed to be more prominent at times, especially when standing. The lump had enlarged gradually, but during the 6 months prior to examination growth had been marked. Aside from some urinary frequency the patient had no symptoms. Examination showed a large movable non-sensitive mass filling the upper and central portion of the abdomen. A gastric analysis was not made. Roentgenograms did not reveal retention

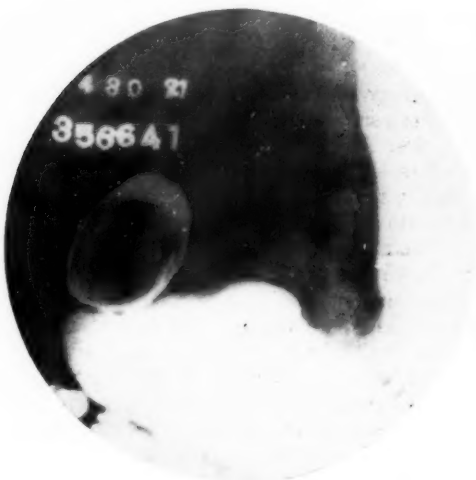

Fig. 10. Large, rounded, mobile mass in a dilated duodenum.

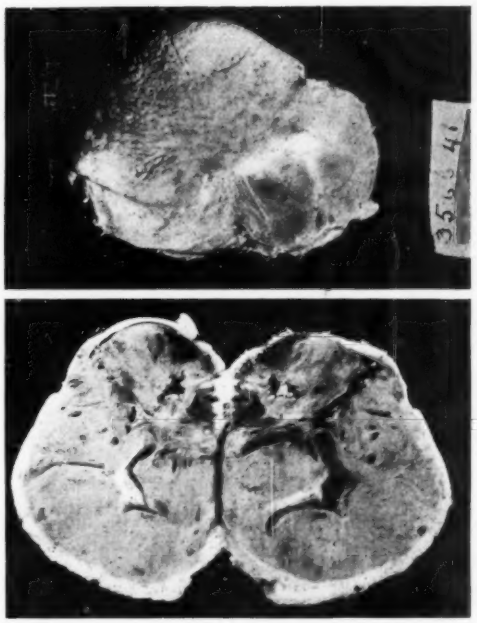

Fig. 11. Photograph of angioma (7 by 5 centimeters) removed from duodenum proximal to the pyloric sphincter.

from the six-hour barium meal. The stomach was very high, occupying a transverse position. The displacement upward was due to a large palpable tumor which was extrinsic and did not deform the gastric lumen (Fig. 12). At operation a gourd-shaped tumor, weighing 1,000 grams, was found attached to the posterior wall of the stomach and projecting into the lesser peritoneal cavity. The tumor was larger than the stomach itself. This was diagnosed dermoid cyst by the pathologist (Fig. 13).

Gastric polyposis. This is probably the rarest form of benign tumor of the stomach. The only case seen in the clinic has been described in detail by Balfour. He states that the tumor was then found for the first time out of approximately 69,000 abdominal operations, 8,000 of which were for gastric lesions. Carman has seen only two cases in about 50,000 roentgen-ray examinations of the stomach, one of which was the one described by Balfour; the other was the case of polyposis reported by Myer. As a result of Myer's own careful clinical observations over

Fig. 12. Stomach displaced upward, occupying a transverse position.

a long period in this case, and of similar observations made in the cases of Wegele and Chosrojeff, he states that gastric polyposis is more than probably present when such a combination of acute gastric hæmorrhage, achylia gastrica, increased gastric motility, and abnormal mucus production of an egg-white character is observed. Achylia gastrica, hypermotility, and excess of mucus were present in our case, that of a man aged 31, with distressing epigastric symptoms of 8 years' duration. The roentgenograms in both cases are quite characteristic and show a diffuse mottled appearance of the pars pylorica and the lower pars media without 6-hour retention or a corresponding palpable mass. This mottling is due to the displacement of the barium by the approximation of the polypi which, offering no resistance to the X-ray, produce numerous small, black shadows in the silhouette of the stomach (Figs. 14, 15, and 16). Ruggles has recently reported one case with detailed roentgenological findings. This tumor was described as a

Fig. 13. Dermoid cyst (weight 1,000 grams) of the posterior wall of the stomach in a boy aged 8.

papillomatous rather than an adenomatous structure, as originally described by Menetrier. Finney and Friedenwald reported two cases of gastric polyposis which had undergone malignant degeneration.

Adenomata. There were two of these tumors in the series, both were small and in women aged 27 and 30 respectively. The first tumor, 2.5 centimeters by 1 centimeter, was situated 1 centimeter above the pylorus and was a Brunnerian adenoma, first described by Hayem. It was mural, apparently symptomless and was excised during the course of an operation for gall-bladder disease. The second one, found during the course of an exploratory operation, was also symptomless, and was a small, hard inflammatory adenoma, 5 centimeters above the pylorus on the lesser curvature. Novak and Stretton have recently reported single pedunculated adenomata on the posterior wall of the stomach, near the pylorus, in adults, causing symptoms simulating those of gall-stone colic. The literature dealing with the various types of gastric adenomata has become fairly extensive.

Polypi. The term polyp in the clinical or descriptive sense signifies any small pedunculated tumor. The majority of polyps are undoubtedly mucous. We have restricted the use of the term to adenomatous or papillomatous growths in conformity with pathological terminology. There were three of these in the series. All the patients were

Fig. 14. Roentgenogram of gastric polyposis.

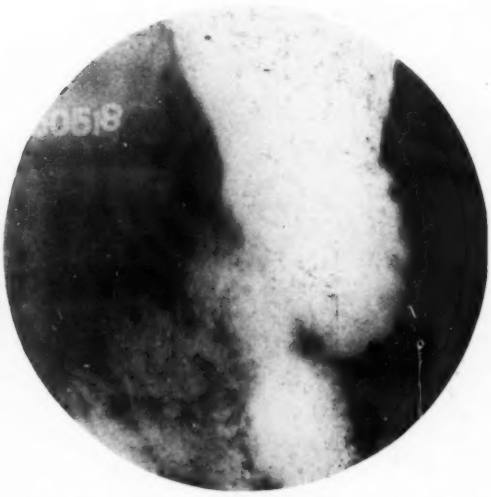

Fig. 15. Appearance in the roentgenogram of the stomach after Pólya resection.

women. The tumors had been found during operation for other major conditions. Two of the polyps were adenomatous, both single, one small, near the pylorus, the other 11 millimeters by 8 millimeters on the posterior wall, 7.5 centimeters to 10 centimeters above the pylorus. In a third case, that of a woman aged 38, the polypi comprised multiple papillomata, scattered throughout the stomach and jejunum, and varied in size from 5 millimeters to 3 centimeters. This patient had a chronic duodenal ulcer.

SUMMARY AND CONCLUSIONS

The 27 cases of benign tumors verified at operation, comprise seven different varieties in which are included myomata, with their histological subdivisions, fibromata, hæmangiomata, dermoids, polypi, adenomata, etc. They represent 1.3 per cent of all the gastric tumors which have been operated on. Seventeen of the entire number were clinically classified primary growths because they were found to be the chief cause of the patients' complaint. Perhaps the most interesting group in this series, because of comparative rarity and size, is that of the hæmangiomata. Twelve of the patients with this condition were males and 15 were females. The ages varied from that of a boy of 8 with a 1000 gram dermoid on the posterior wall of the stomach, to that of a man of 67 with a hæmangioma on the anterior wall and body of the stomach. The largest number, seven in each, was found in the second and sixth decades of life. One-half of all the patients were more than 40. In 13 cases the tumors were in close proximity to the pylorus, in 5 they occupied the posterior wall, in 5 the anterior wall, and in 2 they were generally distributed throughout the stomach. In one case in which the œsophagus and jejunum were involved, and in one, an early case, the records do not state the exact location. The size and shape of the tumor were variable because of the various types encountered. The majority were sessile rather than pedunculated. Gastric analysis and symptomatology afforded little aid in the diagnosis. Practically all the smaller tumors were symptomless. Seven patients had palpable tumors, 3 of which were fibromyomata, 3 were fibromata, 1 was a dermoid, and 1 was a leiomyoma. The average loss of weight in the primary group was 25 pounds. Ten patients had recurring hæmorrhage with anæmia and weakness. This was chiefly due to ulceration or erosion of a portion of the tumor. Three of the 4

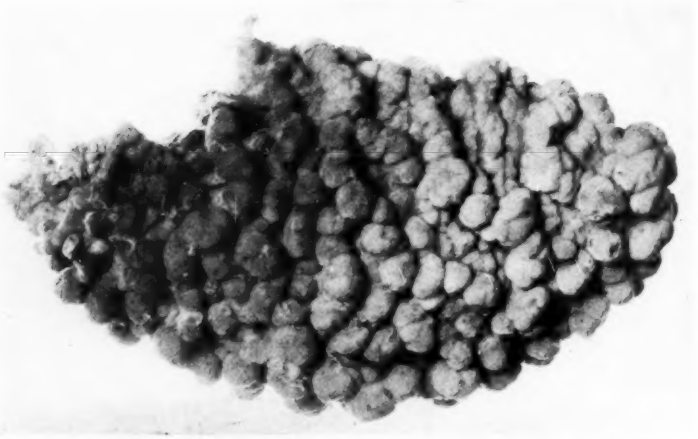

Fig. 16. Gross specimen showing gastric mucosa studded with polyps.

patients with angioma had severe bleeding and anæmia. Seven patients had obstruction; this includes one patient with a fibromyoma of the posterior wall which had caused an intussusception of the posterior wall of the stomach into the duodenum. Severe, painful seizures simulating gall-stone colic were noted in several cases of juxtapyloric tumors which even though not pedunculated could be manipulated as ball-valve tumors. Myomatous tumors of the pylorus, with or without pyloric obstruction, simulate the duodenal ulcer syndrome. The roentgenologic appearance of the larger tumors is quite indistinguishable from that of gastric cancer. Carman believes that a larger experience with this group will enable him to differentiate roentgenologically the two types more frequently than has been possible heretofore.

1. Benign tumors of the stomach are rare and constitute only 1.3 per cent of all gastric tumors that have come to operation. The actual proportion of benign new-growths to malignant new-growths or ulcerations is as 1 is to 200.

2. Myomata and fibromata constitute the largest group, gastric polyposis the most infrequent.

3. About 50 per cent of benign tumors are found in patients more than 40. There is no characteristic syndrome and gastric chemism ranges from achylia to hyperacidity with hypersecretion. The summation of evidence favors the diagnosis of gastric cancer.

4. The majority of the tumors are situated in the region of the pylorus, the greater curvature, anterior and posterior walls.

5. The smaller tumors are practically symptomless unless situated at the orifices or unless multiple.

6. Common complications are recurring hæmorrhage, which occurred in 37 per cent. and pyloric obstruction which occurred in 25 per cent. Palpable mass, food retention, or 6-hour barium retention is less frequent than in gastric cancer.

7. Often patients with benign gastric tumors are refused operation because the condition is regarded as malignant and inoperable. The true nature of the lesion is discovered only when the patients insist on operation.

8. The surgical end-results are excellent.

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INTERSTITIAL PREGNANCY

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DESPITE the relatively large number of interstitial pregnancies observed and operated upon in different clinics, the characteristic signs of this anomaly of gestation have not so far been described sufficiently clearly to enable one to differentiate in clinic this variety of extra-uterine pregnancy from any other variety. Its variable development and the symptoms peculiar to each case render clinical diagnosis almost impossible. Even the macroscopic anatomy of the specimens studied in many cases is open to discussion and presents obscure points. Waegeli (1) makes special mention of this in his review which includes the majority of cases reported up to 1915—more than 50 undisputed cases. Vaudescal emphasizes the importance of microscopic examination saying that in many cases histological study has not been made and that in many of the cases a diagnosis of interstitial pregnancy is questionable. According to Vaudescal microscopic examination is the only absolute means of confirming the presence of an interstitial pregnancy.

By reporting new cases, and by studying each case carefully, we shall certainly some day be able to recognize the signs and symptoms which will enable us to make a clinical diagnosis. We have had occasion to operate upon two cases of interstitial pregnancy, and we report below the findings in them.

CASE 1. Left-sided unruptured interstitial pregnancy. Abdominal supravaginal hysterectomy with ablation of the adnexa.

Anne Ch., age 26, entered Hospital Celtza, July 11, 1919 (No. 495). The family history revealed nothing of importance. The periods began when the patient was 13 and have always been irregular and associated with dysmenorrhœa. The patient has been pregnant seven times; four pregnancies terminating in normal labor and puerperium, three in abortion at about 6 weeks, without complications. The patient claims never to have been ill.

Present illness. The last menstrual period began March 25, 1919. About 2 weeks following the time for the appearance of next period, the patient was taken with severe pelvic pains and a sudden hæmorrhage which was followed by the expulsion of a white membrane. The bleeding with expulsion of the membrane was ascribed by the patient to an abortion. Since this time (about 2 months ago) there has been irregular loss of blood, extending over periods of 1 to 3 days, and repeated approximately every 8 days. Because of this bleeding, the patient decided to enter the hospital. Aside from the metrorrhagia there was no complaint of other functional phenomena, neither pain nor leucorrhœal discharge. The general health of the patient was good, there was no elevation of temperature. Examination of the principal viscera and systems failed to reveal any appreciable pathology. The breasts showed neither lacteal secretion nor areolar changes.

No tumefaction was found in the pelvic cavity by abdominal exploration. The cervix was hard and turned to the left. The external orifice was transverse with a laceration to the left. With the speculum, an ectropion of the anterior lip of the cervix could be observed. The body of the uterus was displaced to the right, it was increased in size, in anteflexion with a slight lateroflexion. The fundus was normal on the right. On the left could be felt a rounded sessile tumefaction the size of an egg and incorporated with the uterine cornu, without an appreciable demarcing depression and movable *en bloc* with the fundus. The tumor was smooth and

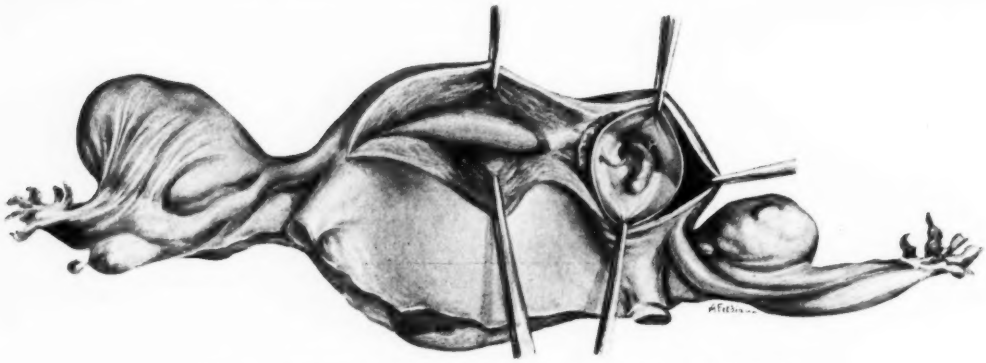

Fig. 1. Cross section of specimen shown in Figure 2, viewed anteriorly.

Fig. 2. Anterior view of left-sided, non-ruptured, interstitial pregnancy, Case 1. The enlarged uterus is composed of two masses; on the right the uterus is of practically normal dimensions, on the left the ovular tumor the size of a large walnut is separated from the uterus by a slight depression. The thickened left round ligament is attached on the anteroposterior aspect of the gestation mass. The left tube, normal in appearance and length (8 centimeters) is attached on the left border of the tumor a trifle lower than on the opposite side. The right tube is somewhat distended and measures 7.5 centimeters. The left ovary is normal and contains a corpus luteum on its superior border. The right ovary, double in size and infiltrated with microcysts, is covered with dense adhesions.

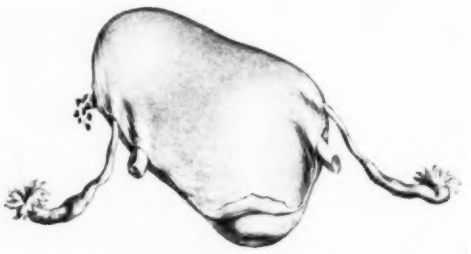

Fig. 3. Anterior view of right ruptured interstitial pregnancy, Case 2. The uterus is normal on the left. At the level of the right horn is a rounded mass, separated from the corresponding border by a scarcely perceptible depression. As a whole the extirpated mass is asymmetric, the right horn forming the apex of a cone. The right round ligament inserts on the antero-inferior aspect of the cornual tumor, a trifle higher than that of the opposite side. The two tubes are apparently normal and are of the usual length.

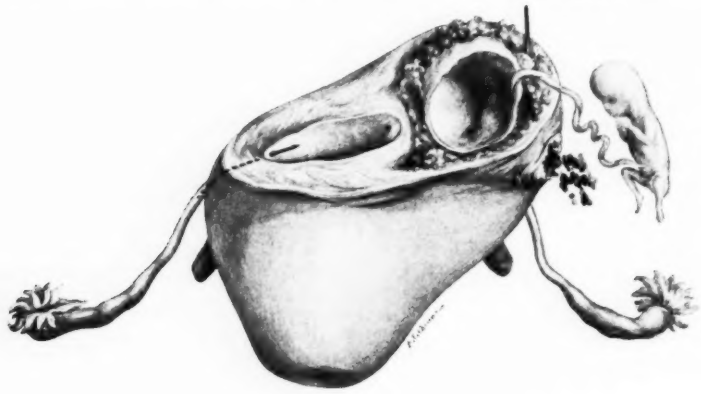

Fig. 4.

Fig. 4. Cross section of specimen, Case 2. A stylet in the left ostium uterinum is shown penetrating the lumen of the isthmic portion of the corresponding tube. The right ostium uterinum leads into the intramural sac. A stylet indicates the position where the tubal isthmus opens into the ovular sac. The ovular sac is formed of a thin muscular wall, containing an intact ovum, covered by placental tissue. An embryo of 10 centimeters is suspended by a delicate umbilical cord from the ovular sac.

a trifle softer in consistency than the uterus. The vaginal fornices were free on the left side both front and back. On the right side could be palpated a swelling which was painful. The swelling was the size of an almond and resembled a right-sided chronic adnexitis.

Operation, July 20, 1919. Lumbar and spinal anæsthesia—0.72 centigrams of novocaine. Medial subumbilical laparotomy. Upon opening the abdomen, the lesions found confirmed the clinical diagnosis: on the left a rounded tumor, on the right the ordinary adnexal lesions. We therefore did a supravaginal, abdominal hysterectomy with extirpation of the adnexa on both sides, peritonization, and closed the abdomen without drainage. The postoperative convalescence was without incident, the patient was up and about on the eighth day and left the hospital in good health on the twentieth.

Examination of the specimen. The specimen secured was composed of the uterine corpus and the adnexa (Fig. 2). From in front the uterine body is of irregular form, and is enlarged toward the fundus to almost double its normal size. It appears to be composed of two masses: that on the right, of a mass normal in outline and of the dimensions of the body of the uterus; that on the left, of a rounded mass situated on the border of the uterus at the level of the corresponding horn and not extending above the level of the fundus. Smooth, rounded, the size of an unhulled walnut and of a trifle softer consistency than the fundus, this mass is distinguishable from the corresponding uterine border by a very shallow, vertical depression more marked upon the anterior face and giving to the whole a bi-lobed appearance. The entire surface of the uterine mass is covered by smooth peritoneum without adhesions.

The transverse diameter of the whole at the level of the tubes is 8 centimeters, the height of the corpus is 5½ centimeters. Viewed posteriorly, the specimen presents the same general aspect except that here the tumor seems more evidently bulging especially vertically as a whole.

The left round ligament is attached to the antero-inferior face of the left uterine mass, at a distance of ½ centimeter from the left tubal attachment. It is a trifle larger than the opposite ligament, having a diameter of 1 centimeter. The right round ligament is attached to the corresponding uterine horn, 5 millimeters below the tube.

The left tube, normal in appearance, is attached to the left side of the uterus, on the antero-external border of the corunal tumor, somewhat lower down than the opposite tube is attached. It is of normal length, measuring 8 centimeters and is permeable.

The right tube, somewhat distended and nodular, is 7½ centimeters long and is surrounded by a few adhesions. The infundibulum is permeable; it is attached at the extremity of the corresponding uterine horn.

Cross section along the uterine fundus for the purpose of studying the interior aspect of the cornual tumor (Fig. 1) shows the presence of an abnormally placed gestation. This section shows the uterine cavity increased in volume in the transverse diameter and asymetric. The left half of the fundus is farther developed than the right and forms a sort of diverticulum, directed upward and laterally. The cavity of the uterus therefore is shaped like an unequal T. The walls of the uterus are hypertrophied; their thickness varying from 8 to 10 millimeters, but beginning progressively to attenuate toward the left horn of the fundus uteri. In the left uterine horn, entirely within the muscular wall is seen an intramural cavity containing a fœtal cyst. The ovum is about 3 centimeters in diameter, or about the size of a small walnut. It consists of an amniotic sac, completely filled with a transparent, pale yellow liquid, which surrounds an embryo of 1.5 centimeters. The small size of the embryo as compared to the duration of the gestation, suggests that the ovum has been arrested in development. Between the ovular membranes and the left wall of the ovular attachment is a deposit of clotted blood. To the right the fœtal cyst over half its external surface is covered by placental tissue. The placenta, adherent to the uterine muscle, can be separated from it by a spatula. The intramural ovular cavity is limited by a layer of muscular tissue of 1 to 3 millimeters in thickness. On removing the fœtal cyst it is found that the ovular cavity communicates freely on the side with the interior of the tubal isthmus. A stylet introduced into the fimbriated extremity of the tube passes backward into the ovular cavity. The left uterine horn communicates by way of the dilated ostium uterinum, through an intermediary canal of about 7 to 8 millimeters in length, opening into the intramural. A partition of 1 to 2 millimeters thickness, easily seen in Figure 1, separates the left uterine horn from the ovular cavity. The mucosa of this horn appears to be interrupted at the level of the canal of communication between the two cavities: uterine and ovular. On the right a fine stylet may be introduced into the natural opening between the uterine horn and the tube (ostium uterinum), visible to the naked eye.

To summarize, we have in this case a para-VII, 26 years of age who, following a delay of menstruation of 15 days, suffered with pelvic pains and metrorrhagia and expelled a membrane, the condition being ascribed to an abortion. Following this painful crisis, the metrorrhagia in scant amount continued for approximately 2 months, for which reason the patient decided to enter the hospital. Because of the history and because of the presence of a tumor at the level of the left uterine horn, we considered the possibility of a fibroid. Laparotomy disclosed a pregnancy abnormally placed in the left uterine wall.

Macroscopic examination showed the ovular cavity entirely within the muscular wall, the round ligament attached below the fœtal tumor, of the normal length of the corresponding tube, all of which findings suggest the anatomical diagnosis of inter-

stitial pregnancy. Unfortunately the disorganization of our laboratories following the war has not permitted us to make a histological study of the specimen.

CASE 2. Ruptured interstitial pregnancy. Supravaginal abdominal hysterectomy with conservation of both ovaries.

Lucrece, J., age 42, entered the Maison de Sante of Dr. Antonin, July 3, 1920, to be placed under observation following curettage in another city. Patient had eight brothers and sisters, of whom two are in good health and two are dead, having succumbed to typhoid. Menstruation began at 12, and the periods have been regular, abundant, lasting 7 to 8 days, and have been preceded and followed by pain. Patient was married at age of 17, and is now a para-VII. She was pregnant the first time 6 months after her marriage. Labor was normal and a living child was delivered. The second pregnancy, 4 years later, was followed again by the birth of a living child. The third pregnancy, some months after the preceding, resulted in the birth of a dead fœtus. A fourth pregnancy, 3 years later, resulted in a living child, which died later of meningeal complications. The fifth pregnancy terminated in an induced abortion at 4 weeks which resulted in pelvic infection lasting 4 weeks and necessitating the opening of an abscess in the iliac fossa. Impregnation occured a sixth time, 6 months after this abortion, and at term a living infant was delivered. Since this sixth pregnancy the patient has been well. Periods have been regular and without pain. Among preceding pathological conditions is mentioned the fact that at the age of 23, the patient suffered from blenorrhagia, this occurring between the second and third pregnancies. The husband was afflicted with syphilis at the time of marriage.

Present illness. The last normal menstrual period occurred April 29 to May 4, 1920. The following period, May 29, 1920, was missed. After 15 days, toward the 13th of June, the patient aborted following curettage by a physician. After this she states that she felt well for about 8 days. Nine days after abortion she was taken with chills and she noted a serous vaginal discharge. Because of persistent nausea and the absence of bleeding, the physician decided to do a second curettage (June 28, 15 days after the first). Following this, there were pelvic pains, localized in the left iliac fossa and the patient came for consultation to Bucarest.

Examination upon arrival. On July 13, 1920, 2 months after the termination of the last period, we found that the patient was suffering some mild pelvic pains, more marked in the right iliac fossa, which became more severe during the following days. There was a scant serosanguinous discharge, without any real bleeding. To these phenomena might be added, constipation, anorexia, and some headache. The temperature remained below 37° for a week, then rose to between 37° and 38° during the following 6 days. Vaginal examination disclosed a long, hard, gaping cervix, an enlarged corpus having almost the dimensions of a 3 to 4 weeks' pregnancy, soft, mobile, and flattened anterolatterally. The uterine cavity measured 8 centimeters, by hysterometry. The left adnexa appeared normal. On the right was found a swelling, the size of a fist, including the uterine border. At first we considered this mass a postabortive right adnexitis.

The patient was placed at rest. She was given vaginal douches and iodine was applied to the uterine cavity. On re-examining the patient, July 10, after 7 days of medical treatment I was surprised to find the uterus enlarged in size, its cavity now measuring 9 centimeters. The organ had developed more markedly toward the right horn. This condition suggested the possibility, despite the two successive curettages, of the presence of an abnormal pregnancy. Upon questioning the physician who had performed the two curettages I was told that he had both times secured what seemed to be ovular fragments. July 10, 9 weeks after the last period and about 1 month after the first curettage, the patient while coming from the dressing room was seized with severe abdominal pains, became pale and fainted, suggesting at once a rupture of an abnormal gestation. The patient was returned to bed, ice was applied to the abdomen, and the subsequent condition closely observed. Temperature 37.8° C., pulse 90. An examination on the following day disclosed a peritoneal inundation of moderate extent, rising to the umbilicus. Clots could be felt in the cul-de-sac of Douglas.

Operation. July 17, 1921, almost 10 weeks after the termination of the last period, the patient was submitted, under spinal anæsthesia, to a median, subumbilical laparotomy. Upon opening the peritoneum there was found extravasated into the peritoneal cavity a large quantity of coagulated and liquid blood. The uterus, increased in volume and asymmetric, presented on its right horn an elongated sessile tumor, the size of an egg, incorporated with it, the whole forming a mass conical in shape. In the posterolateral surface of the cornual tumor was a crateriform perforation, from which blood and clots passed and by which the interior of the sac communicated with the peritoneal cavity. The adnexa of both sides were normal. Supravaginal abdominal hysterectomy was done. Both ovaries were left. Suprapubic peritoneal drainage was established, and the abdominal wall closed with three layers of sutures. Postoperative recovery was excellent, the patient quitting the bed on the tenth day and leaving the hospital on the twelfth day, postoperative.

Examination of the specimen. The specimen from this case consists of the uterus and the two tubes, the two ovaries having been left *in situ* (Fig. 3).

The uterus, increased in size, forms an asymmetric body, ovoid, elongated toward the right horn, and forming an apex, and is occupied by a sessile tumor the size of a large hen's egg. A scarcely perceptible depression distinguishes the right uterine border

from the cornual tumor. The asymmetry is caused by the exaggerated development of the right uterine horn. On the posterolateral surface of the tumor there is an irregular defect, of about 8 to 10 millimeters in diameter. The elevated, smooth, violaceous mass is entirely surrounded by smooth peritoneum, free of adhesions. The vertical diameter of the uterus is 9 centimeters. The axis of the cone formed by the total extirpated mass measures 12 centimeters. The transverse diameter from one tubal insertion to the other is 8½ centimeters. Cross section through the fundus of the uterus toward the posterior aspect, including the superior border of the uterine tumor, discloses the existence of an interstitial gestation (Fig. 4). As can be seen in Figure 4, there are two independent cavities: (*a*) that of the enlarged uterus, and (*b*) that of the ovular sac, hollowed out in the left cornual wall. The cavity of the uterine fundus is increased in size, its two horns are moderately dilated; the right cornu forms a diverticulum directed above and laterally. The thickened uterine wall measures approximately 1½ centimeters. The uterine mucosa is congested. The uterine cavity is separated from the ovular sac by a muscular partition, of the thickness of about 3 to 4 millimeters. One may recognize with the naked eye in the walls of the two horns the tubal orifices (ostia uterina) which were successfully catheterized, by the aid of a fine metallic hairpin. A pin will pass from the uterine cavity into the left tube as may be observed in Figure 4. A fine stylet can be passed from the cavity of the fundus into the ovular sac on the right. The interior of the right uterine horn is a rounded, rather smooth cavity, having an encrusted appearance, and with a diameter of from 5 to 5½ centimeters. Its wall consists of a layer of muscular tissue 3 to 4 millimeters thick, and entirely covered by peritoneum save at the level of the corresponding broad ligament. At the point of rupture the wall of the sac is quite thin, bulging laterally, infiltrated with blood, and separated from the ovum by clotted and fluid blood. In the ovular cavity is an ovum of about 2 months' development, in active evolution. In the amniotic sac, filled with a serous, light yellow liquid, is an embryo 7 millimeters in length. Placental tissue covers about two-thirds of the surface of the ovum. Blood clots and fluid blood has separated the ovum from the lateral wall of the sac.

The round ligament to the right is attached on the antero-inferior aspect of the cornual tumor, 3 or 4 millimeters lower than the insertion of the tube. The left round ligament is attached to the antero-superior surface of the left uterine horn, a trifle lower than that of the opposite side.

The left tube, of normal shape and length (9 centimeters), communicates freely with the uterine cavity. The right tube, of normal shape and measuring likewise 9 centimeters, opens freely into the ovular cavity. A fine stylet, introduced into its interior, passes through the lumen of the isthmic portion into the ovular wall.

Both ovaries, in good condition, have been left in place. The right ovary contains a corpus luteum on its lateral extremity. (We have been unable, for lack of laboratory facilities, to secure a histological examination of the specimen.)

CLINICAL ASPECTS

Interstitial pregnancy manifests itself by variable symptoms, resembling those of other forms of ectopic gestation. The early stage is disclosed, as in both of our cases, and as indeed it is in almost all the published cases, by a delay in menstruation (a delay of 15 days in both our cases) followed, as in our Case 1, by the expulsion of a deciduum, with profuse metrorrhagia. The physical findings are quite variable. There are anatomic forms where the ovular sac is fused with the uterus, incorporated with it, so to speak, the uterus becoming, as in our two cases and in those of Maygrier, Bonnaire and Brac, Rosenthal, Waegeli, Vaudescal, etc. more or less asymmetric. In other forms, the interstitial gestation is clearly distinct from the uterine body as in the cases of Bosse, Léopold, Henkel, Bar and Buffnoir, etc. Between these two types may be found every anatomical intermediary. The variation in the anatomical characters depends according to Vaudescal upon the point of primitive implantation of the ovum and upon its age and its stage of evolution. The result is an extremely variable appearance of the utero-ovular mass, such that an anatomical diagnosis, in certain complex cases, cannot be arrived at even with the lesion in plain sight at the laparotomy.

However, in the majority of cases, upon determining the presence of one or several of the classical characteristics of intramural implantation of an ovum, the existence of an interstitial pregnancy may be determined by simple macroscopical examination of the specimen. There are three principal characteristics which should be considered, viz., asymmetry of the uterus, asymmetry of the adnexa, and lateral insertion of the round ligament.

Uterine asymmetry. Ruge-Simon's sign. This sign exists in the majority of cases (Waegeli) and is characterized by elevation of the fundus on the side of the abnormal horn. Under the influence of the abnormal insertion of the ovum into one of the uterine

horns and of the habitual tendency of an interstitial gestation to develop upward at first, by reason of the conformation of the interstitial portion of the tube (Vaudescal), there occurs a verticalization of the fundus of the uterus producing a cone-shaped organ.

According to Lequeux the presence of the Ruge-Simon sign depends upon the primitive seat of implantation of the ovum. When the nidification occurs in the musculature of the fundus, the ovum develops in an ascending direction producing the sign. When the implantation occurs in the musculature of the lateral wall the Ruge-Simon sign is absent. We have seen in Case 1 that the ovum, instead of developing upward, grows outward from the left lateral border of the uterus, giving rise to the natiform appearance of the extirpated specimen. In Case 2 on the contrary, the asymmetry was due to the ascending or vertical development of the process in the right uterine horn.

Asymmetry of the adnexa. Under the influence of an abnormally developed pregnancy, the tube on the gravid side is usually drawn upward by evolution of the ovum, which produces the asymmetric attachment of the adnexa. The constancy of this anatomical condition is associated with the uterine asymmetry. Here, as for the uterus, Lequeux holds that the respective situation of the adnexa depends upon the nidification and the direction of evolution of the abnormally implanted ovum. When the evolution of the gestation is vertical, the corresponding tubal insertion is drawn upward; when the ovular sac develops downward, the insertion of the tube will be lateral or descendant (Cases of Lequeux, Rosenthal, Glaesner, C. Daniel, etc.) in relation to that of the opposite side, thus producing adnexal asymmetry. In Case 2, despite the ascending position of the ovum, the tubal insertion is scarcely higher on the gravid side.

Lateral insertion of the round ligament. In general, the round ligament of the gravid side is attached lateral to the fœtal tumor, and is displaced laterally together with the tube by the development of the ovum. The insertion of the round ligament varies according as the tube is attached, also, as Lequeux remarked, it varies with the anatomical conditions and the direction of development of the ovum. It may be implanted in the center of the lateral aspect of the ovular mass (Vaudescal); it may be displaced downward (when the gestation has evolved upward, as occurred in both our cases); finally, it may be displaced upward (when the gravid process evolves downward), and it may even be found medial to the gestation mass, as in the cases of Wagner and Lequeux.

Unfortunately none of the anatomical characteristics which we have just described offers any help of clinical value, since in our two cases, as in all published cases, the diagnosis was not established until after examination of the specimen removed at laparotomy. Nevertheless in a thin woman with a flaccid abdominal wall, one might, by palpation, study the situation of the gravid tumor in its relation to the uterus and even the position of the round ligament in its relation to the ovular mass, and thus formulate a possible diagnosis of interstitial gestation. The asymmetry of the gravid uterus (Ruge-Simon sign) and especially the situation of the tumor in front of the uterus, should, according to Professor Bar (1) suggest a pregnancy, either interstitial or cornual (variety which transforms itself into a uterine pregnancy).

The posterior situation of the tumor, in the cul-de-sac of Douglas, is found oftener in tubal pregnancies, properly called. Again when palpation discloses the round ligament attached lateral to the cornual tumor, the possibility of an interstitial gestation is suggested rather than the classic tubal pregnancy. Numerous diagnostic errors are recorded. In Case 1 we confused the unruptured gravid intramural process for a fibroid. In Case 2, with uterine gestation in mind, a colleague did two successive curettages to produce abortion.

Clinical development of interstitial pregnancy is analogous to that of the usual extrauterine gestations. It may become arrested in its development as in Case 1, where a small intact ovum was found in the left horn of the uterus. Exceptionally, interstitial gestation progresses unruptured to the fifth month

(case of Brindeau) and even to the seventh month (case of Bar and Buffnoir). Usually, however, a rupture occurs toward the end of the second month, resulting in either a massive peritoneal hæmorrhage (inundation) or an encysted hæmorrhage (hæmatocele). In Case 2, at about second month from date of last menstrual period, the patient experienced severe hypogastric pains and syncope, and at operation the ovular sac was found ruptured, and there was a peritoneal hæmorrhage of moderate grade. The average age of the patients is 32 years (Villette) for all kinds of ectopic pregnancy. In our first case the patient was 26 years and in the second, 42 years.

ANATOMICAL CHARACTERS

Macroscopic anatomy of the uterus and ovular tumor presents variations in appearance, to which reference has already been made in the general clinical description of the two cases. Alterations occurred in the opposite adnexa in 50 per cent of the cases. The tube and ovary may show every possible alteration. Ordinarily the usual lesions occur, consisting of peri-adnexitis and ovarian microcysts. In our second case the adnexa presented the ordinary chronic inflammatory lesions. In the case reported the condition of the adnexa on the side involved appeared to be normal. Histological study of this condition is extremely important and has been particularly stressed by Waegeli and by Vaudescal, and others. Microscopical study of an interstitial gestation should include a study of the ovular cavity, uterine cavity, both tubes, and both ovaries.

The ovular cavity. This is embedded in the musculature of the uterine wall. The wall of the cavity consists of a thick, smooth, muscular layer covered on the outside by peritoneum and on the inside by a connective-tissue lining containing decidual cells. According to the majority of writers, especially Vaudescal, a slightly marked decidual reaction is found in interstitial gestation at the point of implantation of the ovum, exactly as is found in tubal pregnancy. Certain authors—Martin, Beckmann, Simon, Webster, von Franque—state that a true tubal decidua is found about the walls of the sac which develops at the expense of the tubal mucosa. Other authors—Aschoff, Griffith, Kuhne, Poppel, Futh and Ulesho-Stroganova, cited by Vaudescal—deny absolutely the existence in interstitial pregnancy of decidual reaction of the periovular tissue, as is found in the tubal variety of ectopic gestation. Popper believes that the absence of decidua is one of the characteristic histological findings in interstitial pregnancy. According to the researches of Vaudescal glandular structures indicative of uterine or tubal mucosa are not found at any point.

As the ovum hollows out its location in the uterine musculature, there develops an intimate connection between the chorionic villi and the muscular tissue of the wall of the sac (canalicular or intramural). Very often at places the chorionic villi deeply invade the uterine musculature producing fusion between the migratory ovular cells and the muscular fibers (Vaudescal), thus explaining the rupture of the sac. It is generally believed that decidual transformation of the uterine mucosa is present in interstitial as in all other forms of ectopic gestation (Kussmaul, Beckmann, Couvelaire. According to Vaudescal "the reaction of the uterine mucosa as in all extra-uterine pregnancies is probably variable." In his researches this author found undeniable examples in which the uterine mucosa had not been transformed into decidua. Thus the integrity of the mucosa of the uterine horn and of the mucosa of the isthmic portion of the corresponding tube, would permit the confirmation of an interstitial gestation.

Histological examination shows that the tubes and ovaries are normal on both the gravid and non-gravid sides.

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ESSENTIAL HÆMATURIA

A Clinical Study[1]

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ESSENTIAL or idiopathic hæmaturia is a condition of renal bleeding the etiology of which cannot be determined. It is a clinical diagnosis which is offered when all the present known urological methods have been employed with negative results. The literature is full of theories as to its possible pathology; even the most careful gross and microscopical studies of kidneys removed to save a patient from exsanguination have not yielded constant findings. Many of these have been reported normal; others have shown small isolated areas of chronic interstitial and glomerular nephritis (1), while other kidneys have had nothing but chronic passive congestion, due to obstruction of the urinary outflow or of the blood supply (2), or congestion secondary to cardiac lesions, to explain the hæmaturia. Varices of the papillæ (Fenwick, 3) have been found on sagittal section of the kidney in some of the cases. The theories of hæmophilia (4), and angioneurosis (5) have been offered as an explanation for idiopathic hæmaturia. Hunner (15) believes that ureteral strictures may play an important rôle, and E. L. Young (16) regards obscure hæmaturia as a prenephritic symptom.

It is quite evident that there is no one accepted explanation for a hæmaturia with negative urological findings. From a study of the kidneys removed at operation a single pathological entity cannot be made to apply in all cases; it is quite possible that different factors are responsible. If there is no agreement as to the etiology of essential hæmaturia, clinically however, we deal with this condition as a definite disease the diagnosis of which is always arrived at by exclusion.

It is important to have employed all the diagnostic methods at our command before venturing the diagnosis of essential hæmaturia. The patient should have a careful history and a general physical examination, which should include emphasis on the symptoms and signs of nephritis, tuberculosis, and calculi of the urinary tract. The bladder urine should be examined chemically and bacteriologically; and phenolsulphonephthalein excretion estimated for a period of 2 hours. A Wassermann test of the blood should be done in all cases. The patient should be cystoscoped, the ureters catheterized, and the urine from each kidney examined for pus and infection, including an examination for tubercle bacilli. A differential phthalein, with the estimation of the phthalein excretion for 30 minutes, the urea percentage, a plain roentgenogram of the renal, ureteral and bladder region, a pyelogram and uretergram of one or both sides must be part of the routine. In suspicious cases it may be well to pass a wax-tipped catheter to rule out calculus.

If, after all these investigations, it is found that the patient has no urinary symptoms other than hæmaturia, the physical examination is negative for tuberculosis and nephritis, the urine free of pus cells, casts, and infection, the phthalein excretion within normal limits, cystoscopy negative except as a determining factor of the source of the bleeding, the urine from the bleeding kidney negative for pus and infection and with a normal function, and the pyelograms negative, it may then be concluded that we are dealing with a case of essential hæmaturia. One is never justified in making a diagnosis of essential hæmaturia when the examinations are incomplete or puzzling.

This paper is a clinical analysis of 30 cases diagnosed essential hæmaturia (28 from the service of the Brady Urological Institute and 2 from the gynecological service of the Johns Hopkins Hospital), based on clinical studies of the cases and supplemented by

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conclusions drawn from the replies to a questionnaire. The questions were framed to include the possibility of subsequent development of nephritis, urinary tuberculosis, calculi of the urinary tract, renal colic, operative procedures upon the kidney involved, and recurrence of hæmaturia. A few of the cases have not been worked up as completely as one might wish, and the explanation is that they belong to a period when urological investigation was not as thoroughly developed as now.

In this series of cases patients have been followed from 1 month to 13 years, viz.:

	Cases
Less than 1 year	4
1 to 2 years	5
2 to 5 years	11
5 to 10 years	9
Above 10 years	1
Total	30

Two-thirds of the cases are, therefore, represented as under observation for a period of less than 5 years, and one-third of them between 5 and 10 years.

Sex. There are 24 males and 6 females in the series. It would be unfair, however, to assume that essential hæmaturia is more common among men than among women as most of the cases were drawn from the Brady Clinic, where the majority of the patients are males.

Age. The ages of the patients when they first presented themselves for treatment at the Johns Hopkins Hospital vary from a minimum of 10 to a maximum of 71 years.

	Cases
Under 20 years	3
From 20 to 29 years	1
From 30 to 39 years	5
From 40 to 49 years	9
From 50 to 59 years	6
From 60 to 69 years	4
From 70 + years	2
Total	30

The age incidence of the actual onset of the hæmaturia, as determined from the duration of symptoms, is as follows:

	Cases	Percentage
Under 20 years (6, 16, 19) approximately	3	10
From 20 to 29 years	4	13.4
From 30 to 39 years	4	13.3
From 40 to 49 years	11	36.6
From 50 to 59 years	3	10
From 60 to 69 years	3	10
From 70 + years	2	6.7

In more than one-third of the cases the onset of the hæmaturia was in the fourth decade of life; this represents also the period for the patients most commonly to present themselves for treatment. That blood should appear in the urine for the first time in eight cases between the ages of 50 and 70 is extremely interesting and most important for ruling out the presence of renal or vesical tumor. The youngest individual in whom hæmaturia was noted for the first time was 6 years of age and the oldest 70 years. Essential hæmaturia is not especially a disease of young individuals, as the onset of the bleeding occurred in only 7 cases before the age of 30 years.

Symptoms. Essential hæmaturia is usually symptomless. In this series of 30 cases 13 had had some symptoms accompanying the hæmaturia; these varied from slight pain in the back to typical renal colic attacks. The remaining 17 cases were free from symptoms.

Six cases (3, 8, 14, 20, 21, 23) had mild symptoms—pain in the back or lumbar region—which might have been ignored by the patient if not questioned about them. Urinary symptoms were quite prominent in Case 14, and these may easily have been due to the accompanying prostatitis.

Four cases (11, 17, 22, 25) of essential hæmaturia had suggestive renal colic attacks during the period of bleeding. These were undoubtedly the result of the passage of clots down the ureter.

Glancing over the list of cases with symptoms, one is impressed with the fact that periods of painless hæmaturia alternate with periods when symptoms accompany the urinary bleeding.

Etiology. The pathology of essential hæmaturia is still in dispute. Sex apparently is of no significance. Exertions and injuries play no important rôle though they are mentioned in three cases. In one (Case 29) hæmaturia developed after exercise. In another (Case 23) a blow on the right side of the back was followed by hæmaturia 10 days later, which subsequently proved to be coming from the left kidney. In the majority of cases the hæmaturia developed spontaneously.

Kidney involved. The blood came from the right kidney in 17 cases (57 per cent) and from the left kidney in 13 cases (43 per cent). In no cases were both kidneys involved, at least simultaneously. These observations are in accord with those of most observers, who have reported essential hæmaturia as a unilateral affection of the kidney.

Treatment. The treatment of essential hæmaturia is an interesting phase of urological history. With the advance of urology, the treatment of these obscure hæmaturias has changed. Before the technique of ureteral catheterization was perfected, the therapeutic tendency was operative. Within recent years, however, intrapelvic treatment through the ureteral catheter has been the form of treatment generally employed for these conditions.

In reviewing the literature, one is at once impressed by the numerous claims advanced for the treatment and cure of essential hæmaturia. The procedures have been operative and non-operative. In the former decapsulation, nephrotomy, and, occasionally, nephrectomy have been employed. In the non-operative the hæmaturia has often ceased with the mere passing of a ureteral catheter (Timberlake, 7) or with the injection of adrenalin (Young, 8; Caulk, 9), silver nitrate (Geraghty, Rytina, 6), or serum (Barringer, 10) into the renal pelvis. Sometimes the bleeding has stopped spontaneously. At times the oral administration of calcium lactate, the subcutaneous or intramuscular injection of horse-serum, or the employment of transfusion (11) has helped to clear up a stubborn case of unexplained origin. Focal infections have been sought for and, when removed, have often caused a disappearance of the hæmaturia (Case 12).

Treatment is intimately bound up with remissions and cure, and in essential hæmaturia it is indispensable to consider recurrences of bleeding along with treatment. The literature is full of references to cures of an unexplained hæmaturia by some special form of therapy. Too often the cases have not been followed for a sufficient length of time to judge of the efficiency of the treatment, for patients with hæmaturia, as is well known, have periods of hæmaturia alternating with periods of no bleeding that occur spontaneously. It is well to bear in mind, when any new suggestions for treatment are offered, that they may represent a temporary cessation of the bleeding and not a cure. From the study of our cases we find that two of the patients (Cases 23 and 24) had recurrences for the first time after 12½ and 7 years respectively, prior to which they were apparently free of hæmaturia We have thought it best to avoid claims for cure and have grouped our cases conservatively as "Recurrences" (Table II) and "No Recurrences" (Table I).

Of the series of 30 cases, 5 had operative interference for the control of the hæmaturia (Table III); nephrotomy 3 cases, decapsulation 1 case, and nephrectomy 1 case. In the last case (28) the loss of blood was so excessive that a nephrectomy was done to save the patient's life. The postoperative improvement was marked, the hæmoglobin rising from 25 per cent to 60 per cent. At operation an apparently normal-sized kidney was found. On splitting it the pelvis was found filled with a blood clot. There was a gush of blood from the kidney itself, showing that the vessels were intensely engorged. Both on the surface and on section the kidney looked normal. There was no gross lesion to account for the bleeding. Microscopically, the kidney showed nothing remarkable; a few small collections of round cells were apparently the only pathological evidence.

One of the patients (Case 26) had a decapsulation of the left kidney (New York surgeon) in 1911. For 5 years the urine was apparently free of blood. In 1916 the hæmaturia recurred and there have been three recurrences since the operation.

Three nephrotomies are included in the operative list. In one (Case 27) the hæmaturia has as yet not returned over a period of almost 8 years; but in the other two (Cases 24 and 25) recurrences occurred respectively 2½ and 5 years after the operation. In these nephrotomies the kidneys were opened from pole to pole, but nothing grossly abnormal was discovered either in the renal parenchyma or in the pelvis. In one (Case 25), however,

TABLE I.—CASES OF NO RECURRENCES OF HÆMATURIA

Date of Admission	Case No.	Age in Yrs	Period of Hæmaturia	Symptoms	Clinical Findings — Kidney Involved	Treatment	Period Free of Hæmaturia	Present Urinary Symptoms	Present General Health	Present Age in Years
Feb., 1912	5	63	Painless hæmaturia for 2 months.	Dull pain in right back.	Right. Normal functions. X-ray and pyelogram negative.	Pyelogram. Hæmaturia ceased after pyelogram.	7½ years	None	Good	70
Nov., 1911	27	71	11 months	Painless	Right. X-ray negative.	Nephrotomy	7½ years	Nycturia 2 – 3 times.	Good	80
Mch., 1913	3	48	3 weeks	Slight pain under costal margin.	Right. X-ray and urine negative.	Spontaneous	6 years	None	Good	54
Aug., 1917	6	42	18 months	Painless hæmaturia. Occasional pain left back.	Right. No infection, normal function. X-ray and pyelogram negative.	Pyelogram	2 years	None, except for occasional "smarting" on urination.	Good	44
Oct., 1917	8	29	2 months	Painless. Occasional pain in left lumbar region.	Left. No infection, no casts; normal function. X-ray and pyelogtam negative.	Pyelogram. Horse serum and $AgNO_3$ (3 per cent) twice in left kidkidney pelvis.	1½ years	None	Good	31
June, 1918	7	63	1 week, 1910 1 week, 1911 2 months, 1918	Painless hæmaturia. Nycturia once.	Left. No infection, no casts. X-ray and pyelogram negative except nephroptosis.	Pyelogram	6 months	Nycturia 2–3 times.	Good	64
Dec., 1919	28	53	6 months constantly	Painless	Right. No infection. No tubercular bacilli. X-ray and pyelogram suggestive of tumor.	Pyelogram. Injection of pelvis with 5 per cent $AgNO_3$ and adrenalin; finally, nephrectomy.	6 months	None	Good	53
Jan., 1919	2	33	2 weeks in 1912. 2 months in 1918.	Painless. Occasional pain after urination in glans penis. Occasional nycturia.	Left. No infection, no casts, no tubercular bacilli. X-ray and pyelogram negative.	Pyelogram	6 months	Nycturia once. Slight pain on urination.	Good	33
Feb., 1919	4	40	6 months constantly	Slight change in size and force of stream.	Right. Normal function; no casts, no infection, no tubercular bacilli. X ray and pyelogram negative.	Complete distention of pelvis with 5 per cent $AgNO_3$.	4 months	None	Good	40
July, 1919	1	50	2 years	Some pain in right back 15 months ago.	Right. No infection, no casts, no tubercular bacilli. X-ray and pyelogram negative.	Pyelogram	3 months	Nycturia once	Good	50
Sept., 1917	9	26	2 weeks	Painless	Left. No infection. Good function.	Pyelogram. Horse serum, calcium lactate.	2½ years	None	Good	29
Oct., 1920	10	10	Intermittent for 4 years.	Occasional frequency. Pain in back.	Left kidney; urine negative; no infection; bladder normal, function normal; pyelogram negative.	Pyelogram. Urine clear 2 days later.	1 month	None	Good	10

TABLE II.—CASES OF RECURRENCES OF HÆMATURIA

Date of Admission	Case No.	Age in Yrs.	Period of Hæmaturia	Symptoms	Clinical Findings	Treatments	First Recurrence	Total Number of Recurrences	Latest Period Free of Hæmaturia	Period Under Observation	Further Treatment	Present Urinary Symptoms	General Health
Dec., 1906	23	36	16 months constantly	Painless hæmaturia; slight pain in right back.	Left kidney. No casts; good function; no infection; X-ray negative.	Hæmaturia disappeared completely in 3 weeks after injection of adrenalin in pelvis of left kidney.	12 years later.	One (1)	Hæmaturia at the present time.	12½ years	Passage of ureteral catheter; hæmaturia persists.	Hæmaturia. Pain in left lumbar region.	Good
May, 1909	24	18	Constant hæmaturia for 1½ months.	Painless; nycturia once.	Left kidney	Hæmaturia disappeared after nephrotomy.	5 years later.	3	2 months	10 years	1st recurrence, $AgNO_3$, pelvis; 2nd recurrence, $AgNO_3$, pelvis; 3rd recurrence, spontaneous.	Nycturia once; voids every 2 hours.	Good
Sept., 1910	15	56	1902, 1 month painless hæmaturia. Irregular intervals 1907–8, 3 months continuous.	Painless. None	Right kidney. No casts, infection or albumin. Slight degree of renal impairment.	Injection 1:3000 adrenalin in pelvis right kidney. Hæmaturia disappeared a few days after discharge	3 years later.	1	5 years	9 years	None	Nycturia once.	Fair
Mch., 1910	25	38	Intermittent hæmaturia for 19 years. Constant hæmaturia for 4 months.	Painless	Left kidney. No casts nor infection. Fair function. X-ray negative.	Nephrotomy. Urine cleared immediately after operation.	2½ years later.	Intermittent for 7 years.	Hæmaturia at present	9 years	None	Hæmaturia painless; nycturia once.	Bad
June, 1911	20	43	Constant hæmaturia for 11 months.	Painless hæmaturia. Dull ache in hips and right loin.	Left kidney. No casts, no tubercle bacilli. Good function. Pyelogram and X-ray negative.	Complete distention of left pelvis with adrenalin; urine clear 8 days later.	1 day, 7 years later.	1	8 months	8 years	Intrapelvic treatment. Dull pain in small of back.	None at present.	Good
Jan., 1915	13	70	7 months continuous	None, except painless hæmaturia.	Right kidney. Diminished function due to enlarged prostate. X-ray and pyelogram negative	1. 5 per cent $AgNO_3$. 2. 1–3000 adrenalin injected into pelvis. 3. Horse serum. 4. $AgNO_3$ injection into pelvis.	2 months later.	2	3½ years	4½ years	None	Nycturia once	Good
June, 1915	14	30	Hæmaturia 2 months in 1912; 4 months continuously.	Frequency; nycturia; painless hæmaturia.	Right kidney. No casts, albumin, no infection. X-ray and pyelogram negative.	Urine cleared fifth day after injection of 5 per cent $AgNO_3$ into pelvis of right kidney.	2 years later.	1 6 months	2 years	4 years	4 per cent $AgNO_3$ injection of right pelvis for recurrence.	Voids frequently; some pain on urination. Nycturia once.	Fair
Sept., 1915	11	55	2 weeks, June, 1915	Renal colic in 1912. Painless hæmaturia.	Right kidney. No infection, no casts; good function; pyelogram suggest. pathol.	Injection 3 per cent $AgNO_3$ into right pelvis. Repeated 3 weeks later.	2½ years later.	1 2 weeks	1½ years	4 years	3 per cent $AgNO_3$ injected into pelvis right kidney for recurrence.	None	Very good
May, 1916	26	50	Irregular attacks 1911–18.	None. Painless	Right kidney. No infection, no casts; function good. Thorium and X-ray negative.	Decapsulation in 1911. Recurrence in 1916. Horse serum used.	1 year later.	3	1½ years	3 years	$AgNO_3$ into pelvis.	Nycturia once	Good

Sept., 1916	17	57	Attacks of renal colic. Hæmaturia 11 weeks continuous.	Painless. Nycturia once.	No infection, some casts. Thorium and X-ray negative. Good function.	Urine clear on examination.	8 months later	2	2 months	3 years	Injection of $AgNO_3$ 1917 in right kidney pelvis. Horse serum. Urine cleared afterward.	Nycturia once. Some pain in bladder.	Goo
Aug., 1916	18	41	Intermittent for 10 years.	Painless	No infection. Right kidney. No casts. Pyelogram negative.	20 ccm. horse serum also $AgNO_3$ and adrenalin into pelvis of kidney.	6 months after discharge.	6	11 months	3 years	None	Nycturia once	Very good
Nov., 1916	22	43	Intermittent for 13 years.	Some pain in right lumbar region.	Right kidney. No infection, no tubercular bacilli. Tortuous dilated ureter.	2 pyelograms after which hæmaturia disappeared.	1½ years later	1	7 months	3 years	None	Frequency every hour.	Good
Jan., 1917	16	65	6 weeks continuous. 1913 for two days.	Painless. None	Left kidney. No infection, no casts. Thorium and X-ray negative.	Adrenalin injected left kidney pelvis; 10 c.-cm. horse serum. $AgNO_3$ pelvis of kidney	1 year later.	1 3 months	1½ years	2½ years	$AgNO_3$ injected left kidney pelvis.	None	Excellent
Nov., 1917	19	38	4 months intermittent	Painless	No infection, no tubercular bacilli. X-ray and thorium negative. Right kidney.	Pyelogram	1½ years continuous bleeding.	None since Feb. 1 1919.	6 months	2 years	None	None	Good
Jan., 1918	12	48	6 weeks continuous	Painless. None	Left kidney. No infection, no casts. Function good.	Urine cleared up after pyelogram within 2 days.	4 days later	1	1 year, 2 months	1½ years	June 7, 1918, two teeth extracted.	None	Good
Oct., 1918	21	64	10 months continuous	Painless; nycturia 4 to 5 times for 2 weeks.	Left kidney. No infection, no casts. No tubercular bacilli. X-ray negative. Pyelogram showed calyces broader than normal.	Hæmaturia disappeared after pyelogram.	1 week	1, Oct. 1918 to April 1919.	4 months	1 year	None	Variable nycturia. Frequency.	Good
May, 1909	29	46	Renal colic May, 1908. Painless hæmaturia for 6 months.	Painless	Left kidney. No infection. Good function. X-ray negative.	Injection adrenalin left pelvis.	No improvement in hæmaturia for one year.	Intermittent	7 years	8 years	None		Dead October, 1918.
Sept., 1909	30	44	Hæmaturia in 1906 for 5 days; intermittent hæmaturia for 4 months.	Painless	Right kidney	Adrenalin, right pelvis (twice).	8 months	2	3 years	6 years	None		Dead May 1915.

TABLE III.—OPERATIVE CASES

Case Number	Operation	Result
28	Nephrectomy, Jan., 1919	Cured — 6 months
27	Nephrotomy, Dec., 1911	No recurrence in 7½ years.
24	Nephrotomy, July, 1909	Recurrence of hæmaturia 5 years later with two recurrences since.
25	Nephrotomy, March, 1910	Recurrence of hæmaturia 2½ years later with five recurrences since. Bleeding at present.
26	Decapsulation, July, 1911	Recurrence of hæmaturia 5 years later with three recurrences since.

the operative note reads that the kidney substance was anæmic with a suggestion of a mild chronic diffuse nephritis. No evidences of recent inflammation, calculi, varices, or tumor were found. In all, the ureters were normal. Small portions removed at operation from each kidney revealed nothing but cloudy swelling. Our nephrotomy results are at variance with those of Payne (12), who as late as 1913 wrote: "In not a single case reported in the literature has this procedure of simple nephrotomy failed to relieve this so-called essential hæmaturia."

The non-operative methods of treatment are varied. The more usual ones are intrapelvic injections, passing a ureteral catheter, subcutaneous or intramuscular injections of horse serum, and oral administration of calcium lactate. Of these, the injection of adrenalin and of silver nitrate into the renal pelvis is the present method of choice. Before reviewing our results of the non-operative treatment we desire to call attention to some interesting experiences in Case 4.

The patient was admitted to the hospital February 8, 1919, with a history of hæmaturia of 6 months' duration, which was diagnosed essential hæmaturia of the right kidney, after careful urological study, before he was admitted. On the day of admission 5 cubic centimeters of silver nitrate (5 per cent) were injected into the pelvis of the kidney. The urine showed some tendency to clear but remained bloody. On February 26, 6 cubic centimeters silver nitrate (5 per cent) were again injected through the ureteral catheter, with no improvement. On March 3, 10 cubic centimeters horse serum were injected subcutaneously, still with no effect on the hæmaturia. On March 8, the pelvis of the kidney was completely distended with silver nitrate (11 cubic centimeters). For 2 days the patient bled profusely, passing large clots, and he complained of pain in the lumbar region. Soon, however, the urine began to clear and on discharge, 12 days after the last treatment, the urine was clear and microscopically free of blood. There has been no recurrence for 4 months.

We have a suggestion to make in intrapelvic therapy for idiopathic hæmaturias. The mere injection of a fluid may not be sufficient to stop the urinary bleeding. The fluid must often be made completely to distend or overdistend the pelvis until the patient begins to complain of pain in the lumbar region. As far as can be determined, Braasch (13) was the first to use this method in essential hæmaturia.

In Case 4 two injections of 6 cubic centimeters silver nitrate had no effect on the bleeding, and it was not until the pelvis was completely distended with 11 cubic centimeters that the hæmaturia finally disappeared. We believe that the mechanical distention of the renal pelvis may produce a cessation of the bleeding in some of the essential hæmaturias. The distention must also be more than momentary; it must be kept up for a few minutes, best produced by plugging the distal end of the ureteral catheter. This form of therapy lends itself to the recent descriptions by Quinby (14) of two cases of essential hæmaturia where the source of the bleeding was apparently just beneath the epithelium of the pelvis and papillæ. As stated before, we believe that the pathology of the obscure hæmaturias is not constant for all cases, and that the etiological factors may be different in each group of cases. Hence, any suggestion for the control of renal hæmorrhage should be taken seriously and employed when methods already used have had no influence on the condition.

The theory of pelvic distention is supported somewhat by an analysis of our cases. In reviewing them we were struck by statements in the history that the patients often left the hospital, apparently after no treatment, with clear urine. A careful study of the charts, however, soon revealed that many of these patients had a pyelogram done in their routine examination. A pyelogram with gravity flow is really a distention of the renal pelvis. (In tables I and II "pyelogram" is meant to signify pelvic distention.) It is quite possible that filling the pelvis with the pyelographic medium may have caused a cessation in some of the cases. It is extremely interesting to note that of the 12 cases with no recurrences the hæmaturia appeared to have subsided in 6 (Cases 1, 2, 5, 6, 7, 10) immediately or soon after no other treatment than the injection of some fluid into the pelvis for a pyelogram. In cases with recurrences

there was a temporary cessation of bleeding for varying periods after pyelography in 3 (Cases 12, 21, 22).

The mechanical distention of the renal pelvis is not advanced as a cure for essential hæmaturia, but is strongly advised in all cases where intrapelvic therapy is employed.

Of 12 cases with no recurrences the following treatments were employed:

	Cases
Pyelogram or pelvic distention	7
Spontaneous cessation	1
Nephrectomy	1
Nephrotomy	1
Calcium lactate (orally)	1
Mixed treatment	1

In these cases, 11 surely had no injections of silver nitrate and of adrenalin into the renal pelvis; and in 1 case the treatment was mixed and it is difficult to determine which form of therapy (pyelogram, horse-serum, or injection of silver nitrate) actually caused the cessation of the hæmaturia. Pelvic distention produced the best results, the urine being freed of blood in over 65 per cent of the cases with no recurrences.

Eighteen cases are grouped as recurrences. In 15 of these with the treatment given there occurred cessation of the bleeding immediately or within a short period in the hospital. Two (Cases 24 and 25) had nephrotomies, and in 4 (Cases 13, 16, 17 for recurrences, 18) the treatment was mixed. In 14 cases where intrapelvic therapy was used (8 with apparently no distention—Cases 23, 24, 15, 26, 14, 11, 29, 30—and 6 with distention—Cases 17, 22, 12, 19, 20, 21), it is of interest to note that most of them cleared up within about 10 days. For the first 2 or 3 days following such treatment the urine often became more bloody, accompanied by passage of clots. Soon the urine began to clear, and within a week or 10 days the patient was discharged with urine macroscopically and microscopically free of blood. The cases with no recurrences have responded about the same to intrapelvic treatments. In three (Case 12, pyelogram; Case 19, pyelogram; Case 29, adrenalin), injections into the renal pelvis had no effect on the hæmaturia. In two cases (Cases 19 and 29) the urine continued bloody for respectively 19 and 12 months, and then stopped spontaneously with no recurrences up to date. In Case 12 the extraction of two teeth with abscessed roots was followed by clear urine 5 days later in a hæmaturia which was continuous for 6 months after pelvic distention. There has been no recurrence for 14 months. It is quite evident that most of the cases diagnosed essential hæmaturia that present themselves for treatment, improve rapidly under observation, particularly if pelvic injections are employed. However, there is a strong tendency toward recurrence within varying periods. In fact, the cases regarded as "no recurrences" will undoubtedly show blood in the urine if followed for a sufficient length of time. One patient (Case 23) was rid of his bleeding for 12½ years when it returned after exertion on the farm. Others have not been so fortunate. Two patients (Cases 12 and 21), whose urine cleared within 2 days after a pyelogram, had recurrences within 2 days and 1 week respectively. In 4 cases (Cases 13, 17, 18, 30) the first recurrence took place within a period of less than a year; and in 9 (Cases 24, 15, 25, 20, 14, 11, 26, 22, 16) it occurred within a period of 1 to 5 years.

As the conclusions of this paper are based on the statements of the patients, it is quite possible that when a patient reports that his urine is free from blood it may contain microscopic blood not noticed by the individual. This happened in a case that is not included in this series. In 5 cases (Cases 1, 6, 8, 11, 12), however, who reported their urine as clear, we had an opportunity to examine the urine and found it to be negative.

The follow-up period in no case of recurrence has been less than a year, though there are 6 cases (Cases 1, 2, 4, 7, 10, 28) with no recurrences that have been under observation for 6 months or less. The patients with recurrences have been followed from 1 to 12½ years, with an average of 5 years. Ten cases (Cases 11, 12, 14, 15, 16, 19, 20, 21, 22, 23) have had but one recurrence. There have been three with two recurrences (Cases 13, 17, 30), two with three recurrences (Cases 24, 26), one with six (Case 18), and

two (Cases 25, 29) with intermittent attacks for varying lengths of time. At the time of writing there are but two patients (Cases 23, 25) whose urine is considered bloody. In ten patients (Cases 12, 13, 15, 18, 19, 21, 22, 26, 29, 30) free of hæmaturia at the present time (including two cases—Cases 29 and 30—whose deaths occurred respectively 9 and 5 years after leaving the hospital) the bleeding of the recurrent attacks disappeared spontaneously without treatment. In the remaining six cases (Cases 11, 14, 16, 17, 20, 24) the recurrences were treated with intrapelvic injections, except Case 24, in which, in addition to these, spontaneous cessation of the bleeding also occurred (third recurrence). The lesson to be learned from these studies is, first, that recurrences are frequent in so-called "essential hæmaturia"; and secondly, that the bleeding often disappears spontaneously.

General health. Of the 30 patients under consideration 2 have died (Cases 29, 30); the first from pneumonia at the age of 54 years, 9 years after leaving the hospital and 8 years after the last appearance of blood in the urine; the second was killed in an automobile accident 5 years after leaving the hospital and 4½ years after the disappearance of the hæmaturia. The renal bleeding, it is evident, was in no way responsible for the death of either patient.

Of the remaining 28 who are alive, the present health is described as good or excellent in 25, as fair in 2 (Cases 14, 15), and as bad in 1 (Case 25, a typical neurasthenic). Even in the 2 cases (Cases 23 and 25) whose urine is bloody at the present writing, the general health is regarded as good in spite of the hæmaturia. It is, indeed, remarkable how little the general condition of the patient is affected by the presence of blood in the urine in these idiopathic hæmaturias. Most of them are robust individuals, going about their business with no discomfort and no complaints other than the hæmaturia. In one case only (Case 28) the loss of blood so threatened the patient's life that a nephrectomy was performed as an emergency measure. Ordinarily, however, the patients do not seem to be influenced by the bleeding, and only occasionally do they develop severe anæmia.

Questionnaire. An analysis of the questionnaires reveals the fact that none of the patients has apparently developed nephritis (absence of œdema and symptomatic headaches), and in those in whom it was possible to obtain a blood pressure reading it was found to be within normal limits (Cases 1, 2, 4, 6, 8, 12, 21, 23) and their urines, when examined, contained no casts. None has had typical renal colic, and none has passed calculi. From the questions asked one is led to infer that urinary tuberculosis has not developed in any case of essential hæmaturia; in fact, tuberculosis in no form has made its appearance. A renal tumor has apparently not developed subsequently in any case of essential hæmaturia; not an individual has had an operation on the genito-urinary tract; and only two (Cases 5, 25) have come to operation (bottle operation for hydrocele, hæmorrhoidectomy, and perineorrhaphy) at any time since the last treatment for the bleeding. Urinary symptoms have been conspicuously absent. Nycturia from one to two times at night has been the most common symptom, and this is not particularly surprising when the ages of 8 of these individuals are known to be above 50 years. In 3 cases (Cases 14, 22, 24) frequency has been present, the first two voiding every 2 hours and the last every hour during the day. With these exceptions, and lumbar and back pains in some of the cases, no urinary symptoms are noted.

Prognosis. From our studies, so-called essential hæmaturia appears not to influence the general health of the patient, nor does it seem to lead to disturbances of the urinary tract later on. None of the patients under investigation has apparently developed nephritis, renal colic, tuberculosis, nephrolithiasis, or renal tumor, and none has come to operation for genito-urinary conditions. Patients have been followed for sufficient time for us to dare offer a prognosis. It appears that we may give patients with hæmaturia, with negative urological findings, a favorable prognosis and assure them that, as a rule, recurrences will not affect the general health.

Only two deaths have occurred in our series and in neither of them has the cause of death been related to the hæmaturia. The question of prognosis in essential hæmaturia appears to be one of the main features of our studies. In view of our findings it does not seem to us justifiable to advise a nephrectomy in the cases with intermittent hæmaturia over long periods. A nephrectomy should be employed as an emergency measure in those cases where life is threatened, or where loss of blood begins to produce definite signs of severe anæmia. As for nephrotomy, we cannot say that the results have been striking (recurrences in 2 or 3 cases); and again, we must condemn nephrotomy on general principles, as we know that this procedure leads to marked destruction of the kidney. Further, in one case of decapsulation there occurred subsequent hæmaturia after a period of no bleeding. On the whole, the operative results have not been better than the non-operative findings. We strongly advise that non-operative therapy be given a fair trial, particularly the methods of intrapelvic therapy with pelvic distention.

SUMMARY

1. The diagnosis of essential hæmaturia should be made only when all known urological methods have been employed with negative findings. It is a purely clinical diagnosis, indicating renal bleeding of unknown etiology.

2. This paper comprises the studies of 30 cases diagnosed as essential hæmaturia, based on clinical studies supplemented by conclusions drawn from a questionnaire, the questions of which were so framed as to include the possibility of subsequent development of nephritis, urinary tuberculosis, calculi of urinary tract, renal tumor, operative procedure upon the kidney involved, and recurrences of hæmaturia.

3. In 36 per cent of the cases the onset of the hæmaturia occurred in the fourth decade of life.

4. The bleeding in essential hæmaturia is for the most part symptomless.

5. In most of the cases the hæmaturia developed spontaneously. Exertion does not appear to play a significant rôle in the origin of these hæmaturias.

6. The right kidney was responsible for the bleeding in 17 cases and the left in 13 cases. In no case were both kidneys involved.

7. The results of operative procedures have not been better than those of non-operative methods. In our series there were recurrences after decapsulation and two nephrotomies. Nephrectomy is the only operation ever indicated, and that only as an emergency measure to save a patient from bleeding to death and not as a routine measure for intermittent hæmaturia over a long period.

8. The non-operative methods have been used with success. These have consisted of intrapelvic injection of silver nitrate and adrenalin, and of the passage of a ureteral catheter; the oral administration of calcium lactate and the subcutaneous or intramuscular injection of horse-serum. Of these the intrapelvic methods have given the best results, and it is of interest to note that in a large number of the cases of the series the urine had become clear within a week or 10 days after this form of treatment.

9. It is suggested that the pelvis of the kidney be completely distended with fluid whenever intrapelvic injections are employed. That distention is an important factor in this therapy is shown in many cases in which the hæmaturia has temporarily disappeared after the injection of an opaque medium for pyelographic studies.

10. The 30 cases have been followed from 1 month to 12½ years. There have been 12 cases with no recurrences of the hæmaturia, and 18 cases with recurrences. Of the latter there are 2 whose urine is bloody at the time of writing. It is not safe to predict cures.

11. Spontaneous cessation of the bleeding occurs frequently in essential hæmaturia.

12. The general health is usually not affected by the loss of blood in essential hæmaturia.

13. From an analysis of the questionnaires, we can easily infer that none of the patients has developed nephritis, renal or ureteral calculus, tuberculosis in any form, or renal

tumor, and none has had an operation on the genito-urinary tract.

14. Prognosis in essential hæmaturia is favorable in spite of the loss of blood and the recurrences of hæmaturia.

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OBSTETRICAL PARALYSIS OF THE PERONEAL NERVE[1]

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PARALYSIS of the peroneal nerve from pressure upon the main trunk of the sciatic nerve in its intrapelvic portion is a comparatively rare condition. It occurs during prolonged or difficult labor, either from direct pressure from a large head in a small pelvis, or from trauma by application of forceps. It may have occurred in a larger number of cases than have been reported, as it may easily be confused with the paralysis caused by direct pressure upon the peroneal nerve as it winds about the head of the fibula, which, in a transient form, is common in obstetrical or gynecological cases, where leg holders have been used.

One might expect to find the condition described in textbooks upon obstetrics, neurology, and orthopedics. On looking over the standard works upon these subjects, however, I have found the condition scarcely mentioned. Shears (1) says: "Obstinate paralysis may result from pressure on nerves that pass over the pelvic brim." DeLee (2) does not mention it at all. Hirst (3) refers to the condition, but indefinitely, and says that the "prognosis is fairly good." Edgar (4) simply speaks of the "general outlook being favorable." Starr (5) does not include it among the causes of injury to the sciatic nerve. Whitman (6), Bradford and Lovett (7), Taylor (8), Tubby (9), and Redard (10) do not mention the condition.

Among the monographs upon the subject I find the following references. Howell (11) reports three cases in which, curiously enough, he states that the onset of the paralysis did not occur until the sixth, second, and ninth days, respectively. All were prolonged labors. Two cases were primiparæ; the other an instrumental delivery. There were no recoveries.

Gordon (12) reports two cases of which he does not give the outcome. Thomas (13) does the same. The earliest reference found is that of Bianchi (14) who says: "These rare paralyses usually follow difficult and prolonged labor, in which the fœtus presents by the vertex and has to be extracted with forceps. The paralysis is almost always unilateral and limited to the distribution of the sciatic nerve. It may be temporary, incomplete or persistent." The majority of the other authors (15) report isolated cases, and say little about differential diagnosis or ultimate outcome.

The following case is therefore reported, as the patient has remained under observation for more than a year.

She was first seen by me at The Hospital for the Ruptured and Crippled, Clinic of Dr. Royal Whit-

[1] From the Hospital for the Ruptured and Crippled, Clinic of Dr. Royal Whitman

man, January, 1920. S. S., Hebrew; married, age 43; chief complaint, paralysis of the left foot. Patient has been married 17 years, and has seven children alive and well; two stillbirths. Previous labors were always easy. Patient was in perfect health up to the time of last labor. Her present illness dates from 11 weeks ago. Labor pains began on a Friday night and continued until Sunday morning when at 10 o'clock forceps were applied and the child delivered with considerable difficulty. It weighed 10½ pounds. and its head was much lacerated. Immediately on her return to bed, the atient was conscious of great pain in both legs, and inability to move the left foot. The pain gradually wore off and on the eighth day postpartum, she attempted to get up, but was unable to walk because of the foot giving way under her. Since then she has been doing her work supporting herself by clinging to furniture. About 1 month ago the power began to return to the flexors of the toes and the calf muscles, which have steadily been growing stronger. No disturbance of sensation has been noticed at any time; no chills or fever followed delivery, and general health has been as usual.

Physical examination showed the patient to be in good condition. She walks with assistance, dragging the left foot. General physical examination is negative. On the left side there is drop foot, resulting from complete paralysis of the extensors of the toes, the tibialis anticus and posticus, and the peronei. The flexors of the toes and calf muscles are apparently normal. The reflexes are normal on both sides. There is no disturbance of pain or temperature sensation, superficial or deep. Motions of both hips are free and painless. There is no sign of injury to the sacro-iliac joints or to the pelvis.

The diagnosis lay between two possibilities. (1) Injury to the main trunk of the sciatic nerve, where it crossed the pelvic brim, either by the infant's head or by the forceps. (2) Injury to the peroneal nerve, where it winds about the head of the fibula, from compression of the strap in the leg holder.

The second injury is by far the more common. In my opinion, the evidence against it was that the tibialis posticus was paralyzed, thus evidencing injury to both trunks of the sciatic nerve. This opinion was supported by the history of complete paralysis below the knee, with subsequent improvement of all muscles supplied by the internal popliteal division, except the tibialis posticus. One might also expect, had the paralysis been confined to the single group of muscles supplied by the peroneal nerve, that during the 11 weeks following the injury there would be at least a tendency to the deformity of equinovarus. Such, however, is not the case. Granting, therefore, that there may have been doubt as to whether or not the tibialis posticus muscle was at that time paralyzed, the patient's history of original complete paralysis below the knee, plus the absence of any muscular contraction, point to the original injury having been to both trunks of the sciatic nerve.

The patient was given a brace with a right angled stop joint at the ankle, and baking, massage, and passive motion were instituted. She took these regularly until October, 1920. The gait improved steadily, due to her increased facility in wearing the brace, but no muscular improvement whatever was noted. She was therefore referred to Vanderbilt Clinic, to the clinic of Dr. Louis Casamajor, for a confirmatory neurological examination. The following report was received from Dr. Hubert Howe. "I wish to report the neurological findings in the case of Mrs. S. S., the patient whom you referred to the Vanderbilt Clinic. She presents a typical picture of paralysis of the external popliteal nerve on the left side. The findings are briefly as follows: The gait is 'steppage', the knee being raised high and foot dropped. As the foot is planted on the ground the arch is flattened, due to paralysis of the tibialis anticus. Dorsiflexion of the foot and extension of the proximal phalanges of the toes cannot be performed, which denotes paralysis of the extensor longus and brevis digitorum, and extensor proprius hallucis. Abduction of the foot is impossible as the peroneus longus and brevis are paralyzed. There is subjective tingling in the dorsum of the foot, but no definite objective changes in sensation. The knee and ankle jerks are present and the plantar reflex is of the normal flexor type. The muscles of the antero-external portion of the leg are atrophied, and fail to react to either faradic or galvanic current. Regeneration is taking place as there is no anæsthesia, while subjective tingling and pain on pressure over the nerve trunk are present."

Dr. Howe speaks of regeneration taking place. Such regenerative processes, however, must be exceedingly slow, as no improvement from the standpoint of muscular action has been demonstrable in 15 months.

The differential diagnosis between intrapelvic and extrapelvic injuries of the peroneal nerve will always be difficult. The crucial point in this case was whether or not the tibialis posticus was paralyzed, a point upon which I regret that Dr. Howe did not express an opinion. The weight of published opinion is that paralysis during parturition from

pressure of the forceps, or of the head in the contracted pelvis regularly gives rise to paralysis of the external popliteal nerve alone. Various theories have been advanced to explain this, the most plausible being that the fibers composing this nerve lie directly upon the bony brim of the pelvis, while the other branches of the plexus lie upon the pyriformis muscle. If this opinion be true, the differential diagnosis must rest entirely upon the history. In this case the history showed: (a) pain in both legs; (b) original complete paralysis below the knee, with subsequent rapid recovery of the muscles supplied by the internal popliteal division of the sciatic.

From a consideration of this case therefore, one would conclude that:

1. In any paralysis below the knee occurring after prolonged, difficult labor or instrumental deliveries, the possibility of intrapelvic injury to the sciatic nerve should be borne in mind.

2. An immediate orthopedic and neurological examination should be made, with a view, if possible, to establishing the differential diagnosis.

3. Apparatus should be immediately applied, to prevent deformity, and to enable the patient to get about with the maximum facility.

4. The prognosis as to ultimate recovery should be exceedingly guarded.

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CONGENITAL OCCLUSIONS OF THE INTESTINES

With Report of a Case of Multiple Atresia of the Jejunum

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THE subject of this paper was suggested by a case recently encountered by Dr. Davis in his practice. From an examination of this case and a review of the literature on the subject it has seemed worth while to make a somewhat detailed study not only on account of its interest from the standpoint of congenital pathology but because of its importance as a clinical problem.

HISTORICAL

As a basis for this study and conclusions we have collected from the literature 392 cases of congenital occlusion of the intestines between the pylorus and anus. The earliest case discovered was that by Calder (1733), who described an atresia of the duodenum, and the first exhaustive review of the subject was made by Theremin (1877). Since Theremin's work a number of extensive papers have been written and the accumulated cases examined. The following deserve special mention: Louis Cordes (1901) presented an analysis of 57 cases of duodenal obstruction; Kuliga (1903) collected 189 cases of congenital occlusions of the intestinal tract and examined particularly the question of etiology; Spriggs (1912) reported 24 unpublished cases and reviewed the literature, his paper is to be especially commended for the careful microscopic studies which it records.

It is very difficult to form an estimate of the frequency of the condition. Theremin's observations at St. Petersburg, so frequently quoted, in which there were 9 cases in 150,000 children show no close agreement with the Vienna statistics in which only 2 cases were found in 110,000 children. Miller (1894) found 36 cases of atresia and stenosis in 65,000 autopsies of children at Moscow. Ernst (1916) found 2 cases reported in 41,000 births at the Lying-in Hospital of Copenhagen. Durante (1901) reports 6 from the Maternité of Paris in one year. Apparently imperforate anus is four times as frequent as other intestinal atresias; it is entirely possible, however, that the discrepancy between the two conditions is one of diagnosis rather than a greater frequency of the developmental defect at the junction of the rectum and anus.

There seems to be no point along the intestinal canal where atresia more or less constantly appears. Even in as short a segment as the duodenum, the lesion may be at any point, and in only about 18 per cent is it opposite the papilla. The following table, arranged in more or less arbitrary divisions, illustrates the positions of atresia in the series we have studied.

	Cases
Duodenum, above papilla	59
Duodenum, below papilla	75
Jejunum	60
Ileum and cæcum	101
Colon	39
Multiple atresia	67

Of the multiple cases slightly more than 50 per cent consist of from 2 to 9 occlusions in the jejunum and upper ileum; 20 per cent are in the small intestines and colon while the remainder are scattered. Apparently about 15 per cent of all cases are multiple, and frequently stenosis occurs in addition to the atresias. If we add the multiple cases of the jejunum to the single lesions of the same region it will be noted that occlusion of the jejunum is relatively as common as that of the ileum. This would seem to oppose the frequently repeated suggestion that congenital atresias are due to developmental errors of the vitelline duct and ileocæcal valve.

CLINICAL PICTURE

This can best be described by detailing the history of our case.

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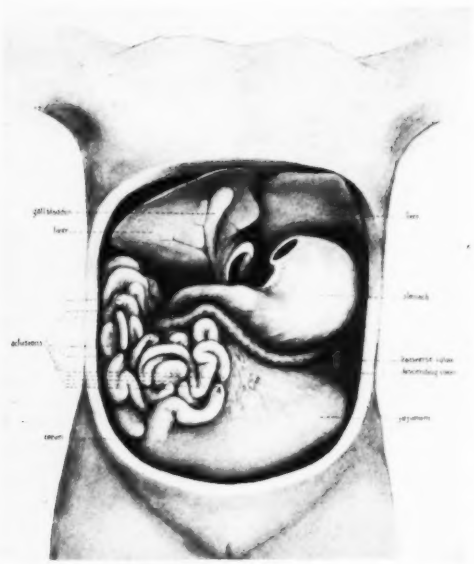

Fig. 1. Shows the viscera in the abdomen. The widely dilated jejunum occupies the left and inferior regions; this contracts suddenly and ends in a blind tube at *a*. The multiple occlusions are on the right. The contracted transverse colon with no great omentum lies just below the stomach.

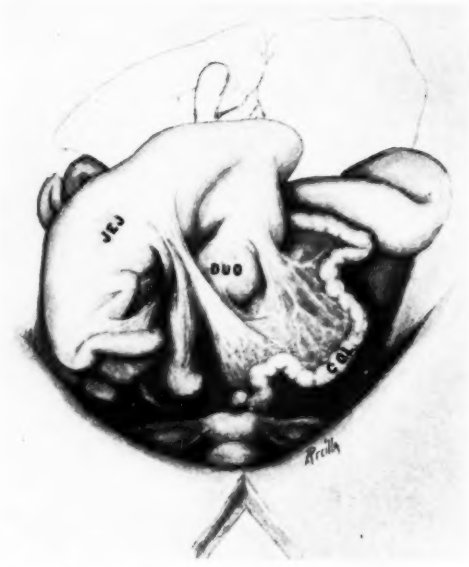

Fig. 2. Same as Fig. 1, except the dilated jejunum *Jej*, is reflected up and to the right to show the dilated duodenum, *Duo*, and the band of adhesion attached to the jejunum.

M. E. K., female, was born late in the afternoon of October 21, 1920. Birth was uneventful and child seemed well nourished and in all respects normal. The parents, late in young life, were apparently free from constitutional diseases. A sister 10 years old was normal.

History. The first 48 hours the babe seemed normal. The first few nursings were retained, urine was voided regularly, and there was a passage from the bowels. The bowel movement was not examined but it is certain from the later examination of the bowel contents that it was made up of mucus and cellular débris with entire absence of bile. Emesis was first observed about 60 hours after birth and continued to occur immediately following any gastric intake; all efforts to produce a bowel movement failed.

Examination. On the morning of October 26, Dr. S. E. Jacobi, attending, called Dr. Davis in consultation. Infant appeared poorly nourished with facies of irritation and distended abdomen. Catheter could be passed for a distance of 8 to 10 centimeters and a barium enema fluroscopic examination, by Dr. N. C. Prince, showed the large bowel patent and normal to the hepatic flexure. The enema could not be forced beyond this point although there was no indication from the picture that an obstruction existed here. It is probable that the contracture of the colon prevented higher introduction of the enema.

Diagnosis. Congenital obstruction of small intestine, probably near ileocæcal juncture.

Operation. Near noon, October 26, under local anæsthesia, right lower abdomen was opened. The blind end of an enormously distended intestine readily presented, to the side of which was kinked and adhered an appendix-like small intestine, shown at *a*, Figure 1. Without further exploration an external enterostomy was made to this distended end from which there was free drainage of chylous fluid mixed with castor oil administered by mouth a day or two before.

Postoperative course. After returning to bed water was taken freely without emesis, but 6 hours later death ensued, no doubt due to exhaustion.

Postmortem examination. Thoracic and abdominal viscera normal except intestines. The duodenum is in normal position but widely dilated, 20 centimeters, and thick walled; this condition includes the pylorus.

The jejumum is much dilated, 30 centimeters, and thick walled for a distance of 16 centimeters, then suddenly contracts to normal diameter, makes an acute flexion on the dilated portion but without stenosis, continues for a short distance and ends in a blind pouch. After a short hiatus there is a segment, blind at both ends, 9 centimeters long. Other segments of varying length follow: 6 centi-

meters, 2 centimeters, 1 centimeter, 11 centimeters, 17 centimeters. Between some of these segments there is a deep notch cut in the mesentery while other spaces show the mesentery intact and with a thin border. All of the segments of intestine are of normal diameter except the fourth which has a diameter of about twice that of the normal. When examined for total length it is evident that about one-third of the jejuno-ileum is lacking, being represented in the spaces between the blind segments. The ileum and colon are normal except the latter is contracted to appear almost "worm like"; it dilates readily under water pressure (Fig. 1).

There are no peritoneal adhesions except a small band from the proximal dilated jejunum to the dorsal wall. This is represented in Figure 2. The mesenteries are normal in position and development, and contain no points worth note except, in the regions of the atresias, there are many enlarged lymph nodes. The mesenteric arteries are normal in pattern and distribution.

Microscopic examination. All viscera are normal except the intestines. The duodenum and jejunum, up to the point where it ends in a blind pouch, Figure. 1, *a*, show the effect of dilation in the mucosa and muscularis mucosa but the muscular wall is much thickened (Fig. 3). This condition of overgrowth of the proximal gut is probably an hypertrophy due to the obstruction. It has been noted in a number of cases. Ducros (1895) said that in one-third of his cases there was hypertrophy of the wall above the occlusion. Spriggs (1912) thought that this thickening was a serous infiltration; in our case, however, there is no question but that there has been a large increase in the muscular elements.

The colon shows more contracture than the ileum but can hardly be termed "worm-like." The microscopic picture shows no abnormality of development. There are, however, many cases on record in which the distal bowel is underdeveloped and very probably to such an extent that it would be incapable of functioning if the occlusion were successfully eliminated.

The contents of the blind segments is mucus, epithelial débris, many small round cells, and a few red blood cells. The picture is one of a degenerative process such as Mall describes in speaking of pathological embryos, as "disassociation." Many fields look like postmortem changes but we can be reasonably certain that they are not because no such changes appear in other portions of the canal (Fig. 4). This cellular degeneration belongs to the mucosa which in many places can not be distinguished from the contents of the canal. Kuliga (1903) and Spriggs (1912) observed in their cases that the mucosa was most markedly degenerated. The muscularis mucosa is undergoing the same degenerative process but to a less degree. The muscular coats are well differentiated but show atrophy and hypoplasia; the muscle fibers are small and irregular and the nuclei much contracted and deeply staining.

In all but two segments the canal ends blindly with all layers present and no indication of a scar. In two segments, or rather in the space between two segments of intestine, muscle fibers are present in heterogeneous arrangement in the border of the mesentery. This muscle seems to be continuous with the outer muscle coat of the intestine. There is no suggestion of a lumen (Fig. 5).

There is lymphoid infiltration throughout the mesentery and the lymph nodes are enlarged but in our opinion this condition is to be related to the degenerative process rather than to bacteriological reactions. There is no evidence at any point of a folding, twisting, or other disarrangement of the mesentery.

We have already noted that the arteries appeared normal on inspection, but when examined in microscopic section, they present an extremely interesting picture and suggest a cause for the degeneration we have just described. In the regions of mesentery where the gut is wanting the arteries are all sclerosed. The general arrangement of this sclerosis can be best understood by referring to Figure 6. In this drawing the normal arteries are shown in relief in the mesentery while the sclerosed vessels are represented by black lines. All of the arteries in the atresic region show some sclerosis. The process seems to be primary in the smaller radicles. Figure 7 shows a large artery in the margin of the mesentery; its walls are greatly thickened and the lumen small. The smaller arcades and particularly the terminal rami of the free mesenteric border are occluded by an overgrowth of cells which seem to be derived from the endothelium. Figures 8 and 9 show the occluded rami. We have found no other case reported in which this condition of the arteries has been described, but since so few have been carefully studied microscopically it is probable that the condition is not so rare as this statement would indicate. It is unprofitable to speculate as to what caused the local sclerosis, but it seems certain that this case cannot be classed with developmental anomalies.

There are certain points in which our case did not correspond to the more commonly recorded clinical picture which may be profitably considered.

Vomiting is almost always present and generally begins on the second day; Helmholz (1907) reported no vomiting but the child lived only 48 hours. Vomiting of blood is often recorded and frequently appears with the first emesis. The exact cause of the hæmorrhage has not been determined. Cowell (1912) reached the conclusion, that: "In most cases the gastrorrhagia is mechanical in origin, resulting from the strain of vomiting on an

Fig. 3.

Fig. 3. A photomicrograph of a section taken through the dilated jejunum and the contracted blind end. *1*, Is a section of the contracted appendix-like end and *2*, of the dilated portion. *m*, Marks the muscular walls and shows the enormous hypertrophy of the dilated jejunum.

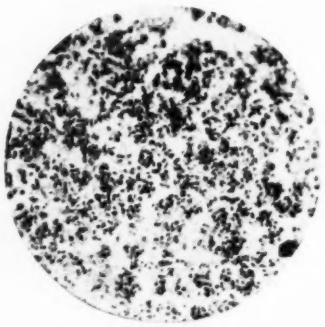

Fig. 4.

Fig. 4. Section through a blind segment near its end to show the degeneration of the mucous membrane.

Fig. 5.

Fig. 5. Section through the mesenteric border between two segments showing persistence of muscle coat, *M*, but with entire absence of lumen.

already overdistended stomach." Bile may be vomited even when the obstruction is above the papilla and can only be explained on the basis of an accessory bile-duct, (Cordes, 1901).

Constipation is usually complete when the obstruction is below the bile papilla, but a little greyish mucus may be passed as in our case. If the obstruction is above the papilla scanty green motions are generally recorded.

In a few cases a slight icterus has been observed at birth, Savariaud (1903) thinks it is due to hypertension in the biliary tract. We are under the impression that icterus is not present in a larger proportion of these cases than in normal newborn infants.

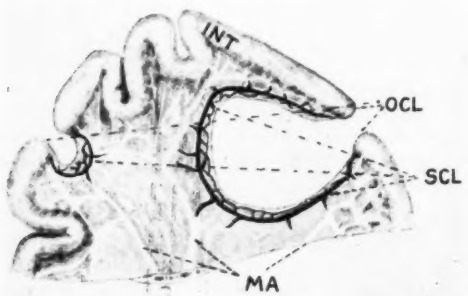

Fig. 6. Drawing to show a segment of intestine, *int*, the mesenteric blood vessels, *ma*, and the position of the sclerosis indicated by the heavy lines, *scl*.

Anuria has been reported in some cases but no cause has been suggested.

ETIOLOGY

In discussing the question of etiology it is important to recognize the dissimilarity of many of the cases. The atresia varies from a simple diaphragm occluding the lumen of the canal to multiple defects of considerable extent, as in our case. The time of occurrence of the lesion is variable. Many cases with the occlusion below the opening of the bile-duct contain normal meconium in the distal bowel, which shows that the obstruction was formed after the third month; other cases with the lesion in the same position show a total absence of bile in the bowel content and would argue for an earlier operating cause.

Developmental errors. Arrest of development as a cause of intestinal occlusion was first suggested by Meckel (1812) who was under the impression that the intestine developed in segments. In 1890 Filimowski and Tandler both found that human embryos between the ages of 4 and 10 weeks show an overgrowth of epithelium in the duodenum which causes, for a short time, an occlusion of the canal. They concluded that this condition might persist and so be the cause of duodenal atresia. Forssner (1907) restudied the question and agreed with the above investigators in their conclusions; he, however,

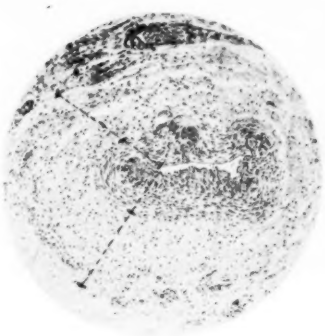

Fig. 7.

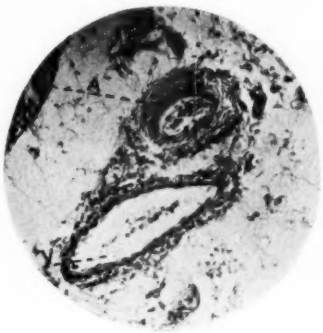

Fig. 8.

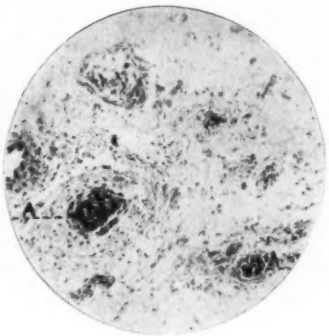

Fig. 9.

Fig. 7. Photomicrograph of a section of one of the larger sclerosed arteries showing the thick wall. The smaller arcades are occluded by an overgrowth of cells which seem to be derived from the endothelium.

Fig. 8. Photomicrograph of a mesenteric artery and vein showing the occlusion of the artery by an overgrowth of the endothelium.

Fig. 9. Photomicrograph of a smaller artery showing sclerosis and complete obstruction of its lumen by degenerating endothelium.

went a step farther and suggested that the same condition of overgrowth of epithelium might occasionally occur in other portions of the canal and so account for occlusions found elsewhere than in the duodenum. Schridde (1908) denies that the duodenum is ever entirely occluded during development. Granting that occlusion normally occurs during development it is difficult to make this fact explain the extensive defects sometimes found in the duodenum, and much more those of the jejuno-ileum and colon.

Bland Sutton's (1889) theory that occlusions occur at the site of an "embryological event," while very satisfactorily accounting for imperforate anus and occlusion at the bile papilla, is not borne out by a study of the distribution of lesions in this series of cases. The statement has frequently been made that these cases are developmental errors because of the large number of other anomalies which are found in association. Such a statement is an error, for in our series there is less than 0.5 per cent of the children showing anomalies; on the other hand the absence of other anomalies is not necessarily an argument against developmental disturbance since all of the more recent experimental teratology shows that there is almost entire independence of lesions. In a certain proportion of our series there is undoubted evidence of developmental disturbance but what the factors are, or how they operate to produce atresias, can, at the present, be only a matter of speculation.

Developmental accidents. Many of the Continental writers have concluded that the condition is due to *Achsendrehung* which may be considered as volvulus. Since various late stages of congenital volvulus have been observed it seems entirely reasonable that this accident is responsible for a number of cases, Gaertner (1883).

Intussusception has been urged by Braun (1902) and Chiari (1903) as the cause of congenital atresia. In the cases which they studied there seems to be no question of the correctness of their conclusions but it is difficult to conceive of this process, or volvulus, acting without disturbance of the anatomical arrangement of the mesentery, which is normal in so many cases.

Strangulation of a loop of intestine at the navel or some other point is without question the cause of a number of cases (Clogg, 1904).

Fœtal pathology. Peritonitis, as the cause of these anomalies was first suggested by Fiedler (1864) who thought that, aside from the atresia, the condition might be so far recovered from as to leave no evidence at birth. This view has been quite widely accepted. A small proportion of this series shows peritonitis still active or evidenced by old adhesions. Enlarged lymphatic nodes in the mesentery are frequently reported, but

it is entirely possible that these are secondary to occlusion of the bowel. It is difficult to understand how peritonitis could produce wide defects in the bowel with blind ends showing no scar; then, too, it is contrary to observation that adhesive bands should draw across a gut so as to sever it in the way that must occur if we are to consider peritonitis as the cause of these cases. It is our opinion that this series of cases offers very little evidence in favor of the inflammatory hypothesis of congenital atresia.

In a certain number of cases ulceration of the bowel has been found and bacteria have been recovered from the site of the atresias. If an ulceration occurred early it might heal leaving only an occlusion at birth. With our present knowledge of fœtal pathology no exact statements can be made but in cases like that of Markwald (1894) and others, microscopic examination strongly supports the view that some factor has caused a degeneration of the mucosa. Our case seems to indicate that *the primary lesion is in the arteries causing a sclerosis and that the degeneration of the mucosa is secondary to this sclerosis.*

DIAGNOSIS

The simple fact of intestinal obstruction presents little difficulty. The exact point of obstruction is extremely difficult to determine. A review of the clinical notes on this series shows that the tendency is to locate the lesion too low in the canal. The presence of bile in the stool or vomited matter may throw some light on the situation of the occlusion; too much weight, however, should not be placed on these findings, for Cordes has shown that an aberrant duct may open above or below the atresia. A late occlusion will show bile in the distal bowel, as a considerable number of cases testify. It is impossible to recognize multiple atresia; therefore the most that can be expected is a diagnosis of congenital occlusion.

PROGNOSIS

The prognosis of congenital atresia is absolutely bad unless the block is overcome. The average age at death is 6 days; there is a slight variation of the time depending on the location of the lesion, the age for duodenal atresia being 5 days and for the colon 8 days. Keith (1910) reported a case of duodenal atresia which lived 9 months; von Tischendorf (1887) and Theremin (1877) cases of occlusion of the lower ileum which lived 3 weeks; Gruneberg (1899) a block of the descending colon which died at 7 weeks. While this series shows only two cases of recovery through treatment we feel that in the future there should be a chance for a larger percentage of cures.

TREATMENT

Obviously surgery offers the only hope of cure, yet less than one-third of this series was subjected to laparotomy.

All cases reported to date, where an external enterostomy has been done as a temporizing measure, have resulted fatally. The most favorable case was that by von Tischendorf (1887) which was operated on on the seventh day and lived for 15 days.

Entero-anastomosis shows more favorable results. Fockens (1911) did an entero-anastomosis for atresia of the lower ileum on an 8-day child and Ernst (1916) did a duodeno-enterostomy for duodenal atresia on an 11-day old child, both cases recovered. Franke's (1898) case of entero-anastomosis functioned, but unfortunately a stitch broke and it died on the third day of peritonitis. In certain cases in which entero-anastomosis was practiced with unfavorable results it was discovered at autopsy that meconium had not penetrated into the contracted distal bowel. This fact has led Clogg (1904) to suggest that the contracted bowel should be distended by water pressure at the time of the operation. Of course the anastomosis should be the most favorable possible compatible with physiological and surgical principles.

From this series of cases and our single experience we are influenced to make the following suggestions.

Operation should be undertaken immediately following the diagnosis, provided, of course, that the infant is not suffering from some other condition which contra-indicates treatment for the atresia.

The anæsthetic to be employed is manifestly procaine infiltration. Spinal anæs-

thesia is not suitable nor is paravertebral justifiable, while ether, either by inhalation or by rectum, is distinctly contra-indicated.

The incision must be long enough to discover all occlusions for 15 per cent of these cases are multiple.

The operation to be performed is an entero-anastomosis either as a lateral or an atypical end-to-end union.

Undilatable and undeveloped distal bowel and widely scattered multiple occlusions are contra-indications to operation.

SUMMARY

Congenital occlusion may occur at any point in the intestinal canal. In 15 per cent of this series it is multiple.

The condition is relatively rare, it occurs once in about 20,000 infants.

There is no one cause for all of the cases. The various etiological factors may be summarized under the following heads: developmental anomalies; developmental accidents, fœtal diseases.

Prognosis is bad.

Treatment should be an entero-anastomosis performed as early as possible.

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PERFORATIONS OF THE ŒSOPHAGUS

Report of a Case of Transpleural Œsophageal Fistula

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A PATIENT has recently come under our observation in whom, following thoracotomy for pyopneumothorax, ingested food was discharged through the thoracic drainage opening. This œsophageal fistula, after persisting for one year, healed spontaneously. In placing this case on record, we have reviewed the various conditions in which the œsophagus has been found perforated into the mediastinum, air passages, or pleural cavity.

Lincoln, L., age 15, referred by Dr. R. W. Dawson, Redford, Michigan, to whom we are indebted for the pre-operative notes.

Family history is negative. There was a vague history of "quick consumption" in a great aunt 9 years before the birth of the patient. Both parents are alive and well. He is the youngest of five healthy children. The patient though always somewhat frail, had been well and of normal growth until his present illness. He had had measles at 10, chicken-pox at 11, whooping cough at 14, and paratyphoid fever of 1 month's duration at 14.

Present illness. On January 22, 1920, during the severe influenza epidemic, he came home from school complaining of a chill and feeling sick. He had been perfectly well the day before. On January 23, one day after the onset of the illness, there was a temperature of 104°, and soon signs of right-sided lobar pneumonia developed. For the first 5 days of the illness, he vomited continually, generally 5 or 10 minutes after taking food. The vomitus was often greenish (bile). It ceased abruptly on the fifth day. The temperature remained continuously high (103–104°) for a week, with respirations 30 to 34 per minute, and then the fever dropped to 100–101°, the respirations still remaining high (30 average). For the next month there was an evening temperature of 101–102°, but the patient seemed comfortable except for rapid respirations. The physical signs of consolidation in the right lower lobe persisted.

On about March 1, he began feeling a sense of fullness in the mid-sternal region on swallowing, and this became gradually worse. After a few days there was continual soreness in the mid-sternal region. He could drink liquids, but any solid food caused severe pressure-pain. The temperature, which had become normal for 2 days, rose to 103°.

On March 9, while eating breakfast, he suddenly vomited about a tablespoonful of foul pus, and became so asphyxiated that the mother thought he was dying. One half-hour later, he vomited a cupful of the same foul pus. This brought immediate relief. There was no further dysphagia, he was comfortable, and temperature became lower.

Dr. Hugo Freund saw the patient the next day. Breath sounds over the right lung were everywhere absent, and expansion was limited on that side. Succussion splash was heard in the right thoracic cavity on moving the patient quickly.

Patient was admitted to Harper Hospital, March 10, 1920.

X-ray on March 10, confirmed the diagnosis of pyopneumothorax. The fluid extended to the top of the fourth rib in front, and could be seen under the fluoroscope splashing in the partially air-filled thorax. The mediastinal contents were displaced to the left (Fig. 1).

Operation, March 11, Dr. Ballin. A three-inch incision was made in the right retro-axillary line. with removal of 2 inches of the right seventh rib. Foul smelling air escaped under pressure, together with some cloudy serum. For 3 or 4 days the discharge was very scant. Then the discharge became profuse and had an odor of butyric acid fermentation. Microscopic examination showed yeast cells and bacillus butyricus. Milk was suspected of being present in the discharge.

March 19, there was an odor of coffee to the discharge. Particles of food were noticed in the dressings, and after this, the amount of food in the discharge steadily increased.

March 21, X-ray and fluoroscopic examination showed a defect in the œsophagus, at the level of the fourth dorsal vertebra, through which part of the barium flowed. It then trickled along the margin of the collapsed right lung, to the vicinity of the drainage tube (Fig. 2).

High temperature, 103 to 104°; pulse, 100 to 104 persisted for several weeks. The food discharge was so alarming that starvation threatened. Gastrostomy was considered, but a Rehfuss tube was introduced and the patient fed entirely through it for 3 weeks.

May 9, he was discharged from the hospital. There was moderate drainage, still containing some food particles. He had gained weight and felt comfortable. Temperature, still present, had fluctuated irregularly since operation about 101, pulse 120. X-ray now showed some dilatation of the œsophagus at the site of the lesion. Less of the barium escaped via the perforation.

Subsequent history. Temperature continued until the middle of June, i.e., for 6 months after onset of

Fig. 1. March 10, 1920, right pyopneumothorax (before operation). Developed during a pneumonia of 6 weeks' duration. Dysphagia and sudden vomiting of a large amount of pus preceded the pneumothorax.

illness. It was 100–101° in the evening, normal in the morning. X-ray on May 21, showed a very small quantity of barium escaping through the fistula.

July 7, only thin fluid barium escaped via the perforation, and then only when large gulps were swallowed. With small quantities, or a thick mixture, there was no leakage. There was dilatation above the perforation, and also pronounced cardiospasm—barium was retained in the œsophagus several minutes. At this time there was noted some expansion of the upper portion of the right lung.

When seen on August 12, there was moderate discharge, which was frequently coffee-stained, or contained other ingested liquids. Patient was pale, with rapid respirations, but was improving in strength and gaining in weight.

X-ray November 16, showed a very slight trickle of barium into the pleural cavity. There was pouching of the œsophagus to the right (Fig. 3).

Shortly thereafter the boy was taken to Asheville, North Carolina.

December 25, 1920, drainage had decreased to a very scant amount of thick, mucoid, odorless material.

X-ray February 5, 1921, showed the lung considerably expanded, now filling two-thirds of the thorax. There had been practically no discharge for 3 or 4 weeks and the tube was removed (February 8, 1921, Fig. 4).

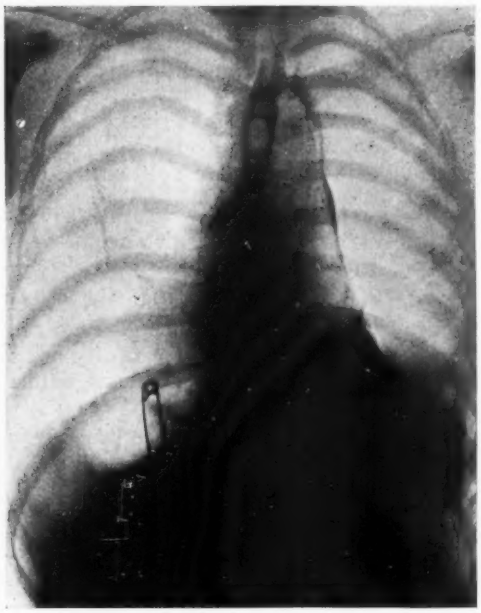

Fig. 2. March 21, 1921. Taken 10 days after thoracotomy. Shows escape of bismuth from œsophagus—transpleura—along the collapsed lung, collecting in right costodiaphragmatic angle and escaping through the drainage tube.

March 10, 1921, a letter from the attending physician (Dr. M. C. Millender, Asheville, North Carolina) and the mother stated that the patient was well, robust, and could climb thousand-foot mountains without fatigue or shortness of breath. He had gained 35 pounds since leaving the Hospital 1 year ago. The wound remained firmly healed.

CLASSIFICATION OF ŒSOPHAGEAL PERFORATIONS

Perforations of the œsophagus have been reported as due to the following lesions:

A. Congenital malformations
B. Neoplasms
C. Aneurisms
D. Trauma
   1. Œsophageal instrumentation
   2. Surgical wounds
   3. Stab and gunshot wounds
   4. Foreign bodies
E. Spontaneous rupture
F. Inflammation
   1. Acute œsophagitis
   2. Diverticula
   3. Simple or peptic ulcer
   4. Luetic ulcer
   5. Tuberculosis

In some of these processes the perforation starts from within the œsophagus (foreign bodies, ulcer, spontaneous rupture, carcinoma).

In others (stab wounds, abscesses, tuberculous mediastinal glands and aneurisms), a pathological process in the neighborhood of the œsophagus breaks into it.

DEVELOPMENT OF ŒSOPHAGEAL FISTULÆ

If the perforation is to the immediate exterior in the cervical region (following stab wounds, œsophagotomy, removal of pulsion diverticula), an œsophagocutaneous fistula results.

If the perforation is into the aorta or auricle (aneurism), it is immediately fatal.

If into the respiratory tract, there will ensue either an œsophagotracheal, œsophagobronchial, or œsophagopulmonary fistula.

If directly into the pleural cavity, a pyopneumothorax develops. Should this break through the thoracic wall or drainage be established surgically, there will be formed a fistula for which we propose the term transpleural œsophageal fistula, i.e., a communication between the œsophagus and skin via the pleural cavity.

A. Congenital atresia of the œsophagus. There are many cases of atresia of the œsophagus on record (1). The œsophagus and trachea are represented by a single tube until the second month of intra-uterine life. Occasionally the mid-portion of the gullet fails to develop; the pharynx leads down a short distance into a blind pouch; then follows a hiatus where no œsophagus can be demonstrated (or it is represented by a fibrous cord). In 60 to 70 per cent of cases, the lower portion of the œsophagus then begins with an opening into the trachea just above the bifurcation.[1] Shortly after birth, it is noticed that the baby cannot swallow, and on attempting to pass a catheter into the stomach, the tube will pass only a short distance down the œsophagus. X-ray shows the barium mixture outlining the blind upper pouch. The child dies during the first 2 weeks of life of aspiration bronchopneumonia. The tracheal fistula is quite constantly situated at or a short distance above the bifurcation, opening into the posterior tracheal wall (very rarely into a bronchus). The upper pouch extends 1 to 5 centimeters below the larynx. (Fig. 4 schematic—from postmortem specimens of two recent cases at Harper Hospital.)

Where there is no fistula, the conditions found include: localized stricture, atresia of the lower portion of the œsophagus, complete absence of that organ, or double œsophagus.

Gastrostomies are ill advised. If not immediately fatal, feeding through the gastric fistula will cause some vomiting and regurgitation up the œsophagus into the trachea (in the event that a fistula is present) leading to suffocation or aspiration bronchopneumonia. Richter (2) has attempted closure of the lower œsophagus in two cases by intrathoracic approach.

The common embryological origin of trachea and œsophagus may conceivably leave a potential fistula which will cause symptoms only later in life. Thus Zuppinger (3) quotes a case where a 24-year-old man was operated upon (how was not stated) for stenosis of the œsophagus. A fistula was found at the level of the sixth cervical vertebra, the size of half a pea, which Zuppinger explained upon the above hypothesis.

B. Neoplasms. Carcinoma of the œsophagus accounts for the majority of œsophageal perforations. The most frequent site of carcinoma of the œsophagus is the middle third of that organ—opposite the left bronchus. Clinically, the patient after 2, 3, or 6 months' increasing difficulty in swallowing, suddenly coughs up some bloody mucus, and then notices that swallowing the smallest quantity of liquid produces a very violent coughing fit, with the bringing up of the ingested liquid mixed with frothy mucus. Usually death results from aspiration pneumonia in 2 or 3 weeks.

C. Aneurisms. Several cases are known where fatal hæmorrhage was caused by an aneurism rupturing into the œsophagus. The rupture is usually preceded by ulcera-

[1] Brenneman (1) states that all the more recent and more exact reports show an œsophageal-tracheal fistula, but Hirsch has just reported a case where there apparently was no such communication—a probe passed up from the stomach into the œsophagus entered and ended in a blind pouch.

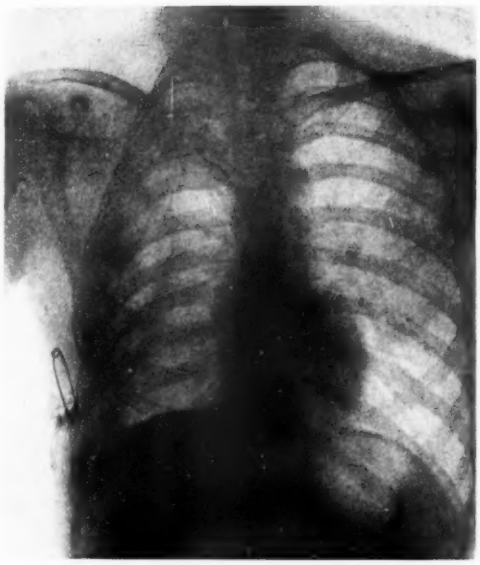

Fig. 3. September 1, 1920. Barium escape diminished. Lung somewhat expanded.

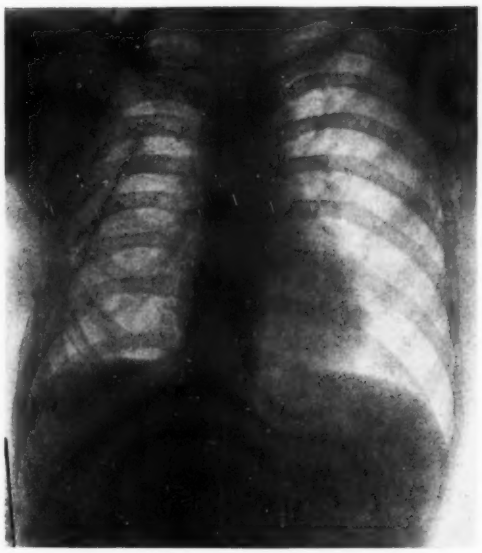

Fig. 4. February 12, 1921. Eleven months after operation. The fistula has closed. A trace of barium left in the intrathoracic scar still outlines the tract of the transpleural fistula. Right lung now fills two-thirds of right thoracic cavity, and is surmounted by a closed pneumothorax.

tion, sometimes gangrene, so that carcinoma of the œsophagus may be suspected.

Two cases have been reported (4) in which an aneurism caused death in the following manner. A small sacculated aneurism at the junction of the transverse and descending aorta, by continued expansile pressure against the posterior wall of the œsophagus, where it crosses the left bronchus, ulcerated a communication between bronchus and œsophagus. Death resulted from aspiration pneumonia without the aneurism itself showing any tendency toward rupture.

A valuable lesson regarding the use of the stomach tube in aneurisms may be drawn from an experience of the late Dr. Donald McLean, often related by him. After a previous visit, he returned to the home of a patient with a stomach tube, to examine him for difficulty in swallowing. On arrival he found that the patient had just died from a hæmorrhage through the mouth. Autopsy showed an aneurism which had perforated into the œsophagus.

D. Trauma. Perforation during dilatation for cardiospasm (5) or by the injudicious use of stomach tube or œsophagoscope are on record. Surgical wounds, stab or gunshot wounds can perforate the œsophagus, forming a fistula between œsophagus and trachea; or, as mentioned above, a fistula between œsophagus and skin. Foreign bodies may ulcerate from the œsophagus into the trachea, sometimes within 48 hours (6). Œsophageal fistulæ in the cervical region have become rarer since œsophagotomy for foreign bodies has been supplanted by extraction through the œsophagoscope.

E. Spontaneous rupture. Several cases are on record, where the œsophagus apparently ruptured spontaneously (Cohn 7). Many of these cases have had a pronounced alcoholic history. There is bloody vomiting, epigastric pain, a feeling "as if something broke inside," and then immediate collapse with dyspnœa and cyanosis. There is frequently mediastinal emphysema. Death results in a few hours. Postmortem shows a longitudinal rip 2 or 3 centimeters long in the cardiac portion of the œsophagus.

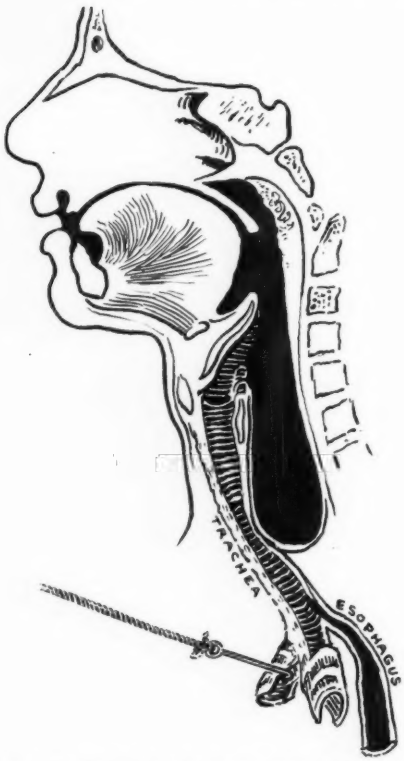

Fig. 5. Congenital atresia of œsophagus. Upper end of œsophagus ends in a blind pouch. Lower end communicates with trachea.

F. Inflammation. (1) *Acute gangrenous stomatitis* may extend down the œsophagus and cause perforation (3).

2. *Traction diverticula* develop following the scar contraction of a lymph node or inflammatory tissue in the region of the tracheal bifurcation. They are mentioned in the literature as liable to perforation, though because of their minute size, and the fact that they rarely produce symptoms, they are probably not of much significance (Judd 8, McCrae 9).[1]

3. *Peptic ulcer.* Two per cent of gastric ulcers occur in the cardiac portion of the stomach. The same type of ulcer has been observed in the lower end of the œsophagus. Kappis (10) collected 15 undoubted cases in 1910. Two-thirds of these had symptoms indicative only of gastric disturbances (pain, vomiting, and hæmorrhage), so that it was impossible to diagnose disease of the œsophagus antemortem. Severe hæmorrhage was an outstanding feature. Four of the 15 cases perforated; 2 into the abdominal cavity, causing death from peritonitis, 1 into the aorta, 1 into the right pleural cavity.

Christie (11) reported the following œsophageal peptic ulcer which perforated into the left thoracic cavity, with confusing signs of ruptured gastric ulcer.

The patient was a male, age 60, who had previously enjoyed perfect health. At 8.30 p.m., a short while after drinking a few glasses of beer, he was suddenly seized with violent pain and vomiting. When seen the next day, he had marked tenderness in the epigastrium and an area of dullness at the left base posteriorly. He was most comfortable when sitting upright in bed. A perforated gastric ulcer was diagnosed, and an exploratory laparotomy performed. The abdominal findings were negative. He died 3 hours after the operation with extreme dyspnœa. Postmortem examination revealed a large left hydrothorax, and a perforation of the œsophagus into the left pleural cavity 2 inches above the diaphragm. The opening was the size of a quarter. It was a simple ulcer with thinned out edges.

One œsophageal perforation was thought to be due to typhoid (12).

4. *Syphilis.* Syphilitic ulceration of the œsophagus is extremely uncommon. Udo Wile (13) was able to collect only a few cases in 1914, but he thinks the condition is probably not as rare as the literature would show. Œsophageal lues is known only as a tertiary sore, a gumma of the submucosa. This may either involute by fatty changes and thereby heal, or there may be early ulceration. Ulceration generally leads to scar contraction and stenosis. It may, however, perforate, as indicated in the following cases.

Schutze (14) reported a case of a woman, age 42, who had had frequent bone abscesses as a child, and had had six miscarriages. By being very careful, she could swallow a very small quantity of water without violently coughing. Postmortem, there was found an ulcer leading into the trachea from the œsophagus, "probably luetic."

[1] Since this article has gone to press, Hawes (31) has reported a case where such a diverticulum gave rise to symptoms and signs of chronic pulmonary tuberculosis with small cavity formation, and repeated hæmorrhages. The patient had observed for many years that "after eating certain foods, such as oranges, the sputum after coughing would contain particles of the above-mentioned foods. She also had coughed up tablets or pills 12 hours after she had taken them, with merely the outside coating gone." The diverticulum was outlined by ingested barium.

Basch (15) reported a case in which death took place 24 hours after intravenous salvarsan, given for nasopharyngeal gummata. The death was found due to a perforated gumma of the œsophagus, which had been unsuspected, and which lead into a patch of lung gangrene.

Dufour (16) reported a case of "extensive ulceration of the trachea below the ring cartilages, with a perforation in the center. No tuberculosis, probably luetic." Female, age 38, Wassermann—positive.

Levy (17) reported a case of a woman, age 24, who died of an œsophagotracheal fistula. No Wassermann was made, but from the microscopic picture (submucus round-cell infiltration and absence of other lesions), he concluded the ulcer was "probably luetic." He cites many other reported cases.

Beeler's patient (18) was a man, age 58, who had had lues 40 years before. Following 6 months' difficulty in swallowing, he suddenly had a hæmorrhage of bright red blood, followed by the usual coughing fit after deglutition. The patient died apparently of bronchopneumonia. Wassermann—positive. No postmortem.

5. *Tuberculosis.* A thick cluster of tuberculous glands in the neighborhood of the bifurcation of the trachea is very common. Their enlargement is almost a daily observation of the postmortem room. Zuppinger (3) collected most of the cases of non-traumatic œsophageal perforation in children reported up to 1903, and came to the conclusion that all non-traumatic œsophageal perforations in children were due directly or indirectly to tuberculosis. The retro-œsophageal lymph nodes may enlarge and produce a stenosis of the œsophagus, with or without breaking into it. This may be the explanation of a mild difficulty in swallowing in childhood which passes off without any demonstrable cause. The first bolus of food goes down with difficulty, the remainder more easily. Secondary rupture of the glands into the œsophagus takes place only after there has been extensive caseation with abscess formation. Often these cases are complicated by caries of the vertebræ.

The following types may be recognized.

a. Perforation from the caseous abscess into the œsophagus. The perforation may be first recognized at autopsy, or there may be more or less dysphagia, pain in the chest, relieved by vomiting of a large amount of material. Some of these children (all of the cases have been in children) survive the local condition and die of abdominal disseminated tuberculosis (3, 19, 20).

b. Perforation of the abscess into the œsophagus and trachea, by far the most common termination. There is a certain uniformity in the pathological descriptions; an abscess cavity in the mediastinum, communicating with œsophagus and trachea or bronchi.

"A round smooth opening of the anterior wall of the œsophagus led into an abscess cavity in the mediastinum, the size of a hen's egg, behind the end of the trachea and the two bronchi. There was an aperture in the right bronchus, one inch from the bifurcation, leading into this cavity" (21).

"Tuberculous, enlarged bronchial gland, necrotic, with an opening between the œsophagus and trachea the size of a finger" (11).

"There were many adhesions in the mid-wall of the left lung, near the aorta. There was a walnut-sized cavity, into the upper part of which two openings lead into the œsophagus. There was much tuberculosis in the left lung" (22).

"Œsophagus communicated with a cavity the size of a walnut, formed from a caseous gland. This cavity communicated with the right bronchus through a two-centimeter opening" (23).

Several of these cases have also shown advanced pulmonary tuberculosis. The lung gangrene may have been thought to follow aspiration of food through the œsophageal perforation (24), or the abscess may have been primary, the perforation of the œsophagus occurring after a few days of foul, putrid expectoration. The pathological sequence then was: advanced phthisis; gangrene with abscess formation at the hilus; perforation into the œsophagus. In Tirard's case (25), repeated chest aspirations were made searching for the abscess before the œsophagus perforated.

Most of the cases of this group have been between 5 and 20 years of age, but there has been an occasional case in advanced age.

Selenkow (26) reported a case of a man aged fifty, who died of œsophageal fistula following 3 or 4 months' difficulty in swallowing. This was thought to have been caused by a carcinoma of the œsophagus with perforation into the trachea. At autopsy, there was a well marked right upper lobe tuberculosis, and an egg-sized cavity in the mediastinum, into which the œsophagus opened.

Incidentally, the contrary mistake is also recorded. A man was treated in various hospitals and sana-

toria for 5 or 6 months for what was taken to be disseminated tuberculous bronchopneumonia. The physical signs, however, varied; at some times dullness, etc., was more marked than at others. X-rays showed varying shadows—at one time a relatively clear lung field was noted one week after a plate had shown many dense shadows. There was only slight difficulty in swallowing coming on 2 or 3 months after onset. At autopsy, a carcinoma of the œsophagus was found, with a small bronchial perforation. Just enough food escaped through this fistula to produce repeated bronchopneumonic patches which then would heal.

TRANSPLEURAL FISTULÆ OF THE ŒSOPHAGUS

Passing by the etiological factor, which in this group of cases cannot always be definitely stated, transpleural fistulæ of the œsophagus deserve special consideration on account of their therapeutic possibilities. This group comprises cases in which the œsophagus perforates into the pleural cavity without communicating with trachea, bronchus, or lungs. We have been able to find reports of only 6 such cases in the literature as follows:

CASE 1. (Osler, 27.) Man, age 34. At 10 he developed a painful right-sided tumor above the nipple. At that time he expectorated considerable yellow material. The tumor would remain prominent several days, then disappear, during which latter time the patient would have pain in the breast, and profuse expectoration. This lasted 3 or 4 years. Then a fistula formed, which was still patent when examined (20 years later).

During a retention period, there was a fullness in the chest, he felt something give, and noticed a corn in the fistula opening. Since than he frequently observed food particles in the dressings. There was frequent slight hæmorrhage from the fistula.

Examination showed a thin emaciated man, with right side of his chest collapsed and right shoulder drooping. There was a fistula in the first right interspace, 3 centimeters from the sternoclavicular joint.

Two weeks later, the man returned. He was much worse, and there was a noticeable depression and tenderness of the first and second dorsal vertebræ. No further observation was recorded.

CASE 2. (McLachlan, quoted by Osler.) A 25-year-old female, who had had severe pain in the right infraclavicular region for many years.

After several months' observation she developed what appeared to be an abscess in her right breast. This was incised, and a large quantity of pus discharged. Six months later the patient noticed food particles in the dressings. If she sat upright, and drank fluids, some came through the dressings.

CASE 3. (Voelcker, 28.) A 6-year-old boy had empyema, a rib resection was done and then he discharged ingested fluid through the empyema wound for many months.

At autopsy, caries of the fifth and sixth ribs and fifth and sixth vertebræ, together with two perforations of the œsophagus at this level were found.

CASE 4. (Martens, 29.) The patient had been under treatment for tuberculosis for 10 years. Seven years ago he had empyema, for which thoracotomy and drainage were performed. During convalescence an œsophageal fistula developed, the origin of which was held to be caseous bronchial glands. Retention made re-operation necessary. After the lapse of a year, the discharging fistula had healed twice, only to reopen. Another attempt to close the fistula failed.

Examination (1903, 7 years after onset of fistula) showed an opening in the right posterior thorax region 4.5 by 3.5 centimeters in diameter, through which a large intrathoracic cavity could be inspected. This was 8 centimeters in depth to the right, 7 centimeters deep to the left. Ten bronchial fistulæ were visible. In the upper posterior portion an œsophageal fistula could be seen alongside the large vessels. When he drank, a small amount of fluid issued from this œsophageal opening. He had been dressed every other day for 7 years, and 3 years ago had undergone a severe knee operation following an injury, with perfect healing. Tubercle bacilli had been present in the sputum in 1896, but not at this time. General condition was excellent.

CASE 5. (Downes, 30.) Twenty-two-year-old male. In April a fluid tumor was aspirated from the right thoracic region, with discharge of fetid pus. Tuberculosis of the sternum was diagnosed. Two operations were performed, during which the sternum, and portions of the right second, third, and fourth ribs were removed. A sinus was seen in the mid-line, the end of which was not apparent. Four days after operation, an orange seed was noted in the discharge, and thereafter food particles appeared regularly in the dressings. In November a gastrostomy was done, and the patient fed himself through the tube for a year, gaining 40 pounds. (This is the only œsophageal fistula which has been benefited by gastrostomy.) Then he could take nourishment through the month, though occasionlly some food would come through the thoracic fistula. No subsequent record.

CASE 6. (John, quoted by Downes, 30, but the reference could not be found.) It was of a child with an abscess of the thorax, through which food came. A gastrostomy was necessary. The child died of tuberculous peritonitis.

To these six reports we wish to add our case.

CASE 7. (detailed above). Summary. Boy, age fifteen. Clinical signs of right unresolved lobar pneumonia persisted 6 weeks. Following a few days' difficulty in swallowing, a large quantity of putrid material was vomited. The next day a right pyopneumothorax was present. A few days

after thoracotomy, food was noticed in the discharge. Temperature persisted for months. The discharge through the œsophageal fistula gradually decreased. The tube was removed 1 year after operation, and healing ensued.

These seven transpleural fistulæ differ from all other recorded cases in that the patients enjoyed life in relative comfort for a long while after the œsophagus had perforated: Case 1, 24 years, Case 4, 7 years. The fistula developed following some isolated suppuration in the chest, either encapsulated postpneumonic empyema or tuberculous mediastinal glands. Clinically two courses can be distinguished: (1) The abscess breaks abruptly into the œsophagus, pus is vomited, secondary infection of the abscess by food particles follows, the process extends to the pleural cavity and very shortly a well-developed pyopneumothorax is apparent. On draining this, food particles appear in the discharge (Cases 3, 4, 7). These steps could be clearly distinguished in our case. (2) The perforation is slower and becomes walled off from the pleural cavity. A spontaneous thoracic fistula develops, which is found to communicate with the œsophagus (Cases 1, 2, 5). Perhaps the first are postpneumonic, the second tuberculous in etiology.

Osler mentions perforation of the œsophagus as a complication of empyema, referring to Cases 1, 2, and 3 above. In his case, he gave no more definite diagnosis.

Zuppinger, as already stated, working in a pediatric clinic, came to the conclusion that all non-traumatic perforations of the œsophagus in children were of tuberculous pathogenesis. The process generally started from caseous bronchial lymph glands, and he mentioned caries of the vertebræ as a frequent complication.

Very acute perforation of a primary œsophageal ulcer into the pleural cavity (Kappis, 10) is quickly fatal. The symptoms are similar to those of a perforated gastric ulcer —abdominal and diaphragmatic rigidity— plus respiratory distress. This type may be more frequent than is generally believed. If the thorax will withstand the infection, and the patient withstand the shock for a short while, the clinical characteristics seen in our case will develop, and the case be available for treatment by thoracotomy.

Difficulty in swallowing, vomiting of pus, followed by rapid development of a pyopneumothorax are suggestive of perforation of the œsophagus. An early roentgenogram showing the barium mixture escaping from the œsophagus into the thorax may in some instances be obtained.

After thoracotomy, a rancid odor of the discharge and the escape of food will render certain the diagnosis. Of course, early and free thoracotomy gives the best prognosis.

In no case previously reported has the fistula closed.[1] Case 4 was observed for 7 years; Case 1 24 years; Case 5, 1 year. In our case, after the fistula remained open 1 year, it closed spontaneously.

Gastrostomy may be indicated if the food discharge threatens to lead to starvation. In our case feeding through a Rehfuss tube left *in situ* for 3 weeks brought the patient safely over the period of threatened starvation, and it also contributed markedly toward diminution of the leakage of food.

Operations for closure of a transpleural fistula of the œsophagus have not been attempted, so far as we know. Perhaps from the happy result in our case the lesson of long-continued conservative treatment, after proper drainage through a thoracotomy has been established, may be drawn.

[1]Hawes (31), in the article above referred to, also reports a case of œsophageal fistula complicating a lung abscess. In this case the perforation had first taken place between the œsophagus and the lung abscess. The abscess was then opened by rib resection, and food was discharged from the wound. The fistula closed in about three months.

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PSEUDOHERMAPHRODITISMUS MASCULINUS INTERNUS

Congenital Malformation in Scrotum—Two Testes and Uterus in Right Portion of Scrotum[1]

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MALE; age 38; single; admitted May 27, 1918; occupation, factory hand. Patient complains of rupture, pain, and mass in right groin. He thinks he has had a mass as long as he can remember but that it has been more pronounced for the past 25 years; during the last 4 days, it has increased in size and has become painful.

Diagnosis. Congenital mal-descent of testis with uterus in the right portion of the scrotum.

History. Since the age of 5 or 6 years he has had a swelling in the right groin; he thinks this followed a kick. The swelling has appeared and disappeared at intervals during the past 32 years. Last winter, it was much smaller for several months without the use of a truss, which he has worn most of the time as long as he can remember.

Last week he had a vomiting attack accompanied by headache. A few days later, 4 days ago, the swelling in the groin increased and extended to the scrotum. There was considerable pain, which has persisted. He has had no vomiting for 4 days.

Past history. Patient had scarlet fever in childhood. Several times he has had headache and vomiting which lasted one or two days. He does not smoke or drink. Two years ago he had a gonorrhœal urethritis of which he has never been completely cured. There is no history of lues.

Physical examination. He is a well-developed, well-nourished man in no apparent pain or distress. The skin and mucous membranes are of good color. The left axilla has a palpable gland; otherwise normal. The chest is well formed; the expansion is good and equal; the vocal fremitus is normal; percussion is normal, lung is resonant throughout; auscultation is normal. The pulse rate is 70, regular and of good volume and tension; the vessel wall is just palpable; the heart has a normal beat, it has no murmurs. The upper teeth are false, the lower poorly kept. The tongue is clean; the abdomen moves freely on respiration; it is equal and symmetrical. Deep and superficial reflexes are present; there are no pathological reflexes. There is no costolumbar tenderness; there is no pain or tenderness along the ureters or over bladder. The right side of scrotum is greatly enlarged; there is no tenderness. There appear to be two round masses, with an irregular mass in the center, which extends well up into the inguinal canal, where there is a marked impulse on coughing; this scrotal mass does not transmit light. The left scrotum is small and no testis is present. No perineal dimpling. The prostate is normal in size, contour, and consistency; in the region of the right seminal vesicle there is an elongated mass which extends up as far as the finger can reach; the left seminal vesicle is small and firm. The urine is clear, dark amber, acid, 1019, no albumin or sugar. Microscopic examination shows no pus, but many urates. The Wassermann is negative.

Operation, May 30, 1918, for congenital dual testes in right scrotum with congenital hernia, by Dr. MacKenzie; ether by Dr. Grant. Through a right inguinal incision, the inguinal canal was opened. The cord was found large, hard, and continuous to scrotum; the hernial sac identified, freed, ligated at neck, and resected.

The mass consisted of two moderately sized testes in right scrotum with a large mass between, which extends up the canal and down the course of the vas (Fig. 1). One testis was freed, placed in warm gauze with its pampiniform plexus and vas intact. The other testis with oblong mass attached was freed well into pelvis, ligated here, severed with cautery and removed *en masse.* The first testis was replaced in scrotum and wound closed by Bassini method.

Convalescence uneventful. May 25, 1920, active spermatozoa were found in seminal fluid.

REPORT ON SPECIMEN

Mass from right side of scrotum. The specimen received, removed from the right scrotal sac, consists of a well-formed testicle of normal size and apparently intact tubules. Quite closely attached to it is an elongated, pear-shaped organ measuring 9.5 by 4 centimeters, with a central canal, which on being opened presents a well-formed mucous membrane, supported by a thick muscular wall. This organ-like structure (uterus) lies below the testicle in the scrotum, the larger end being dependent. It conforms in general with the appearance of a juvenile uterus, being narrow and possessing a long cervical end. To the left lower aspect a well-formed fallopian tube 6 centimeters in length is attached. This tube shows a rudimentary fimbriated extremity and a small pedunculated cyst, which apparently corresponds to a cyst of Morgagni. A well-marked epididymis can be made out on the posterior surface of the testicle and from this a tortuous tube (vas) runs up on the posterior surface of uterus and toward its upper extremity becomes embedded in its posterior wall, but the cross section shows a well-marked lumen. Surrounding this cord, and embedded in the con-

[1] Read at Urological Society, New York Academy of Medicine, April 27, 1921.

nective tissue are a number of smaller cord-like structures, some of which have a very definite lumen; others appear obliterated. Running along the left margin of the uterus is another quite thick cord-like structure, which takes origin near the isthmus of the fallopian tube and becomes embedded toward the upper end in the wall of the uterus. The upper end on section shows only a minute central lumen, while toward its other end it is apparently convoluted and on cross section shows three lumina from which can be pressed a whitish fluid.

Sections from what appears to be a uterus show a mucous membrane which is lined by a surface columnar epithelium and consists of a very cellular stroma, the cells of which resemble very closely those of a normal uterine mucosa. Embedded in this are a number of tubular glands, which, although rather irregularly arranged, tortuous and small, are lined by a single layer of high columnar epithelium. The mucosa is supported by a rather vascular, but quite typical muscularis. Diagnosis: abbreviated and juvenile uterus.

Sections from the fallopian tube show a well-formed and definite structure consisting of folds and projections of mucosa, which are lined by a simple columnar epithelium and which surround a lumen. This mucosa is supported by a muscular layer and covered by a serosa, which shows marked œdema. Quite closely attached to the tube and included in the same section are numerous cross sections of tubules, which resemble very closely those of an epididymis. Diagnosis: fallopian tube and tissue from epididymis.

Section from the testicle consisted of testicular tubules which are evidently actively functionating, as many spermatozoa can be demonstrated.

Sections from the cord-like structure in the posterior aspect of the uterus show a very thick walled muscular tube with a small lumen in which lie a number of papillary projections lined by stratified columnar epithelium. Diagnosis: vas deferens.

Another section taken from somewhat similar structure lying along the lower wall of uterus shows a similar but much smaller vas deferens.

Sections from the rather soft elongated mass which lay near the fallopian tube and which was thought possibly to be ovarian tissue, show the mass to be made up of cross sections of tubules resembling those of epididymis; therefore, probably epididymis.

These findings in a man who presented all the masculine anatomophysiological characteristics in addition to a uterus and a fallopian tube, led me to look up the literature, where I found 26 very similar cases with several more of the same embryological genesis. They all have strong masculine characteristics, although a few are hypospadias or pseudo-feminine. Only a small portion of these men had children, as those reported by Braithwaite, Craig, and Brindeau. In one-quarter of the cases the uterus was double; when single it was usually atrophied. The testicles were normal in only a very few cases; they were generally atrophied and degenerated. The uterus continued into a vagina opening into the urethra, a fact which explains the escape of blood from the canal, as has been noted after the operation.

EMBRYOLOGICAL GENESIS

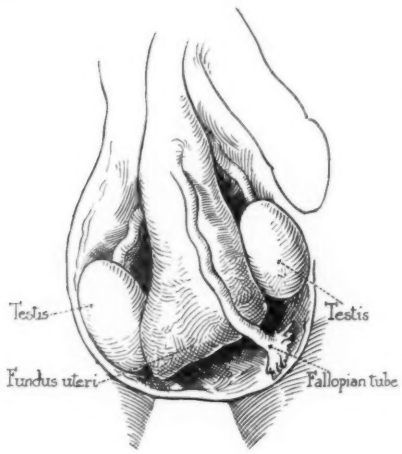
Hermaphroditism is divided into two groups:

1. Hermaphroditismus verus, in which an individual is truly bisexual and in possession of independent testicles and ovaries, or, at least, one ovary and one testicle. Recent investigations have made the existence of hermaphroditismus verus doubtful, as in the cases so far reported the histological evidence has been lacking or has been incomplete. A few cases of fused, so-called ovotestis, have been reported.

1. Pseudohermaphroditismus. This is divided into pseudohermophroditismus masculinus and pseudohermaphroditismus femininus, in which a predominant typical and complete sexual organization of one type is associated with an incomplete or complete set of sexual organs of the opposite sex, but without sex gland (ovary or testicle). It may, therefore, be subdivided into: (1) pseudohermaphroditismus internus in which the internal organs of the opposite sex exist. (2) pseudohermaphroditismus externus in which the external organs of the opposite sex exist, and (3) pseudohermaphroditismus completus in which both are present. Pseudohermaphroditismus masculinus is the most frequent. Up to 1908 Neugebauer collected altogether 910 cases of pseudohermaphroditism and in these 722 were of the masculine variety, and only 188 of the feminine variety, while 613 of the whole series were examples of pseudohermaphroditismus masculinus externus (see Birnbaum, A clinical manual of malformations, etc., translated by Blacker, MacMillan Co. 1912). It can again be subdivided into pseudohermaphroditismus masculinus internus and externus. In the internus are present, besides well-developed, typical, external and internal male genitals, vagina, uterus and tubes which usually terminate in the situation of the colliculus seminalis. The case recorded above belongs to this category.

In the pseudohermaphroditismus externus the external parts of the female type are present.

All cases of hermaphroditism are intelligible on the basis of the embryological sexual development. For in the early fœtal life, during the period of mesonephric development, the human organism is bisexual or possesses, at least, all the



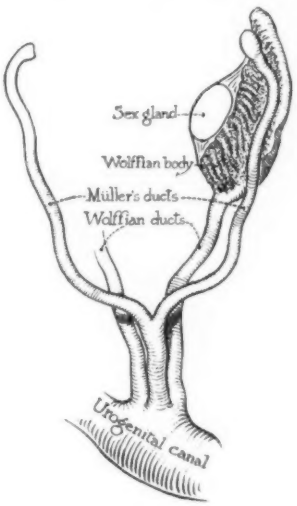


Fig. 1 (at left). Schematic view of condition as found at operation.
Fig. 2. Schematic view of embryogenesis of muellerian and wolffian ducts.

tructures necessary for the development of both sexes. At this time there develops a ridge along the border of either mesonephros. This gives rise to Mueller's duct, a cord-like structure which later forms a tube. On either side, this lies internal to the wolffian duct (primitive ureter) and terminates with the wolffian duct into the urogenital sinus. As the sexes differentiate, the fate of these structures is dictated by (1) the development of the sex gland (ovary or testis) which develops from the genital tubercle of the mesonephros. The latter then disintegrates, leaving only a small part which in the male goes to form epididymis, seminal vesicles, coni vasculosi, vasa efferentia and ejaculatory duct; while in the female it forms the paroophoron; the duct of Gartner and the parovarium. (2) The fate of Mueller's ducts. As the male development proceeds, these involute as early as the seventh to the eighth week. Only rudiments remain as the utriculus masculinus (prostatic sinus) and hydatid of the epididymis. In the female, however, Mueller's ducts continue to develop and to reach the height of development in fusion, anteriorly to form the tubes, posteriorly, to form uterus and vagina. Pseudohermaphroditismus masculinus means, therefore, embryologically considered, persistence and more or less complete or, as in this case, partial, rudimentary or infantile development of the muellerian ducts to uterus, tubes, and vagina which terminate in the normal prostatic sinus. The cause of this lack of involution, but persistence and development of the muellerian ducts in these cases is not known. It is possibly connected with lack of proper determination of sex characters (hormone action). In favor of this is the occasional co-existence of other physical and mental female characters. These secondary characters were lacking in this case. The individual was apparently a full male. But here also the female organs were underdeveloped, infantile in type, as in Webster's case.

Interesting is the peculiar rotation that occured in the hernial descent to the scrotum, so that the fundus which originally points upward in the abdomen occupies the lower position in the scrotum.

The literature on pseudohermaphroditism has been reviewed by Neugebauer (1). Since then the following cases have been reported of which Webster's case is nearest to the one described above.

Clark tells of patient of normal male appearance, 30 years old. He had been married 6 years but he had no children. An operation for hernia on the left side drew from the abdomen a normal testis, uterus, and tubes. There was no testis in the scrotum.

Brindeau's patient was a soldier 35 years old. He was married and was the father of two children. An operation for a right scrotal hernia revealed a mass containing a normal uterus with right tube

and also a testicle with vas. The left horn of the uterus had another tube within the abdomen and when drawn upon it brought down a second testicle of normal appearance, with vas.

Braithwaite and Craig report a left hernial operation on a boy 14 years of age. Traction in the hernial sac revealed in the end the internal organs of generation of a female with the exception that the positions usually occupied by the ovaries were filled with atrophied testes.

Pellegrini reports a case in which a uterus with both tubes, together with two testicles, was found in the right hernial sac of a child 26 months old with normally developed male genitals.

Fantino reports the finding during an operation for a right-sided hernia on a boy 18 years old of both a uterus with tube and a testis, arranged from below upward as right testicle, uterus and tube, left testicle.

Viscontini reports having found on a well-developed man 22 years old, during an operation for hernia, a mass containing a uterus with left tube. The scrotum contained two normal testicles, on the right and the left sides.

Duse reports an operation for a right-sided hernia on a man 20 years of age. Both testes were situated in the right side of the scrotal sac. In following the vasa to the abdominal cavity a unicornate uterus of infantile type was found.

Webster reports on a specimen sent to him while he was surgeon in our own hospital. This specimen is almost identical with our own case above.

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SARCOMA OF THE PROSTATE[1]

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WE report the following case with a digest of the literature on sarcoma of the prostate in the adult, first, because of the comparatively few reports to be found in the literature, and second, that in so far as we have been able to ascertain there has been no case reported in a man of the advanced age of our patient.

W. H. C., age 71, was referred, October 31, 1919. His chief complaints were that of dysuria and frequency accompanied by symptoms of urinary obstruction. He had been losing flesh for about 6 months and had periodic attacks of gastro-intestinal disturbance. Reference of Mr. C. to the gastro-enterologist and the neurologist failed to lead to the discovery of any gastro-intestinal or nervous pathology that could be ascribed as the cause of the emaciation or the gastro-intestinal symptoms. Blood examination and Wassermann test were negative. Urological examination showed by rectal palpation an enlarged and soft prostate. The urethral length was increased to 25 centimeters. No obstruction was met in passing a No. 20 French soft rubber catheter. There was 120 cubic centimeters residuum and the bladder capacity was 200 cubic centimeters. Cystoscopic examination showed a large uniform intravesical prostatic outgrowth, a generalized cystitis and trabeculation. The ureter openings were not seen and as the examination was painful no prolonged attempt was made to find them. Personal circumstances prevented an immediate hospital admission for prostatectomy, so palliative treatment was instituted until he entered the hospital on January 23, 1920. Within 24 hours after admission to the hospital Mr. C. developed a pneumonia which further delayed operation. On February 14, an attempt at suprapubic prostatectomy was made. Upon introducing the finger into the urethra to start enucleation, it was obvious that something different from the ordinary was being encountered as there was no line of cleavage and the substance of the growth was so friable that it had to be removed as best we could with a gall-bladder scoop and flushing. Enough pieces were gathered to send to the laboratory, and the following report from the pathologist is presented.

"Report of examination of several small fragments of whitish friable tissue, case of Mr. C., the largest about 4 millimeters in diameter. The larger fragments were composed of closely packed, small, round, mononuclear cells with an occasional cell of large size with more cytoplasm, with very small amount of connective tissue scattered through the growth in small fibers and short trabecular-like masses showing no definite arrangement. Some of these masses were partly surrounded with loosely formed connective-tissue walls infiltrated with the round cells. Poorly outlined blood vessels appeared in the growth and a few atrophied gland tubules were visible in some of the fragments. The specimens presented the characteristic structure of round cell sarcoma."

Mr. C.'s convalescence from operation was uneventful. His suprapubic wound closed and normal urination became established in 3 weeks. He was discharged from the hospital, March 10, 1920. By the "follow up" his physician advises me that "while Mr. C. has no urinary symptoms and no evidence of trouble with the wound, his general condition is not good." We will continue a "follow up" on the case and report the ultimate result at some future date.

A sarcoma of the prostate may start primarily or may transplant itself from the testicle or elsewhere. The small round-celled form appears to be the most frequent. H. A. Royster's (1) statement that they often result from injury has been challenged by Schepelmann (2) who lays down the dictum that "there is no possibility of a neoplasm having been caused by injury, if the interval between the accident and the development of the tumor is more than 3 or 4 weeks."

One of the earlier, seemingly well-authenticated cases has been recorded by Coupland (3): a man, aged 29, with a "lymphosarcoma." However, J. Ewing (4) doubts the diagnosis of lymphosarcoma, as the structure of the gland does not favor the growth of such tumors.

Wharton (5) has put on record the case of a man, aged 55, with retention of urine. The patient died on the ninth day after operation. Postmortem revealed a round-celled sarcoma of the prostate.

A case quite similar to that of Wharton has been reported as early as 1873, by Socin (6), regarding a man, aged 51, who died of septicæmia, 5 weeks after catheterization.

West (7) reports the case of a man, aged 21, with difficult micturition. The disease took a rapid course. Autopsy showed a large tumor composed of small round spindle cells.

[1] Read at the meeting of the American Association of Genito-Urinary Surgeons, Rochester, Minnesota, June, 1920.

H. Hill (8) has seen the specimen from a man, aged 64, who had died suddenly after suppression of urine for 10 days. The growth consisted of an abundant stroma of fibrous tissue, containing many spindle cells.

C. L. Gibson (9) reported the case of a man, aged 35, who 4 months previously had been operated on; the portion removed was a small, round cell sarcoma of the prostate. However, the tumor grew rapidly and 4 months after the first operation rectal examination showed a mass the size of a fist occupying the prostatic region. Combined suprapubic and perineal operation was followed by death from exhaustion.

A second case reported by Gibson (10) was that of a man, aged 36, admitted for urinary trouble. An irregular mass replaced the prostate. The tumor grew very rapidly. The patient died of exhaustion. Microscopic examination showed a round cell sarcoma, moderately vascular. Gibson reported the above cases to this society in 1904 and 1909.

Charles E. Powers (11), in 1908, was consulted by a man, aged 60, for rapidly increasing difficulty in urination. Rectal examination revealed a very large, rounded, slightly nodular prostate. He succumbed on the fifth day after operation. Examination of the masses removed showed a small round-celled sarcoma of the prostate. In reviewing the literature, Powers considers this form as the most frequent, and the condition occurring most frequently in childhood.

Analyzing the cases tabulated by Powers (9) and Proust (12) and eliminating those in the latter's tabulation not accepted as authentic, up to the year 1907 we have 33 cases. To these must be added a case report by Cabot (13) regarding a man, aged 75, with a small spindle cell sarcoma; and a case described by Bobbeo (14). Moreover, Depage (15) successfully removed a prostate from a man, aged 25. Microscopic examination showed a small round cell sarcoma.

In 1909, J. R. Eastman (16) reported the case of a man, aged 27, with a spindle-celled sarcoma of the prostate apparently running a course covering 5 years. Eastman believes that sarcoma of the prostate is less rare than had been imagined, owing to the circumstance that until recently very little distinction had been made between carcinoma and sarcoma. Pouchet (17) reiterates the fact that sarcoma in adults is rare.

Newman (18) reports the case of a man, aged 35, with retention of urine following an injury. The entire prostate was found occupied by a growth which proved to be a round-celled sarcoma. One of the important features in this case was the primary existence of a small, well-encapsulated sarcoma of the prostate, which had given no symptoms before the injury to the perineum when the rupture permitted the rapid growth of the neoplasm.

The common symptoms, besides the presence of the tumor, are dysuria, retention, hypogastric and perineal pain. The treatment is symptomatic and palliative. J. F. Warbasse (19) urges enucleation. Others recommend radium treatment at the earliest moment. Pfahler (20) claims X-rays will cure the majority of cases. Deaver (21) calls attention to the rapid growth of sarcomata.

The *New York Medical Journal* (22), editorially dwelling on the malignancy of prostatic sarcoma, points out that as the neoplasm grows in the adult less rapidly than in children, operation offers more chance of success in the adult. Early diagnosis is important; in elderly subjects, disturbances of micturition and the appearance of a tumor in the hypogastrium and perineum leading to the phenomena of cachexia should cause suspicion.

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UTEROPLACENTAL APOPLEXY (HÆMORRHAGIC INFARCTION OF THE UTERUS) IN ACCIDENTAL HÆMORRHAGE

Report of a Case and Study of the Clinical and Pathological Data of Sixty-Eight Cases in the Literature[1]

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HISTORY

SINCE Rigby established the differentiation between antepartum hæmorrhage due to placenta prævia and that due to premature separation of the normally implanted placenta, the etiology of the latter condition continued practically unknown. Traumatism from without or from within through traction on an absolutely or relatively shortened cord, sudden reduction in the size of the uterus from the birth of a twin, or the emptying of the membranes of an excessive amount of amniotic fluid, inflammatory changes in the decidua, even violent emotion, were all, from time to time, advanced as etiological factors of significance. Later the association of albuminuria with a large percentage of these cases attracted attention, and the idea was advanced that the placental separation was determined by hæmorrhagic lesions in the decidua which were associated with the presence of a nephritis, usually chronic in character. As early as 1903, Muus of Copenhagen advanced the hypothesis that accidental hæmorrhage was a manifestation of a pregnancy toxæmia, and called attention to the frequent association of eclampsia with these cases.

To Couvelaire, however, undoubtedly belongs the distinction of having made the first really important contribution to this subject since that of Rigby, a contribution which has not only served to focus attention on accidental hæmorrhage and to blaze an approach to its study from an entirely new angle, but promises, possibly, to aid materially in the investigation of the whole broad subject of toxæmia in pregnancy. In 1911 in one case, and again in 1912 in two cases, he described in great detail the gross and histological findings in the uterine wall in accidental hæmorrhage. These consisted, in brief, of an extensive subserous ecchymosis and of a marked hæmorrhagic infiltration of the myometrium, tearing the muscle bundles apart and even disassociating them fiber from fiber. These lesions he believed to be toxic in character. It is true that prior to Couvelaire's first paper there were in the literature a few reports of similar changes in the uterine wall in cases of accidental hæmorrhage, but none of the authors seems to have been much impressed with the importance of his observation. Couvelaire's work immediately attracted attention in France and in Europe generally, and in 1913 Essen-Moeller contributed an important paper in which he reported five cases of this type. In concluding this paper he said:

"There are two genetically different forms of accidental hæmorrhage. The one is caused by trauma; the other is due to an intoxication of the same kind which causes albuminuria, eclampsism, or eclampsia. . . . The extensive bleedings in the uterus (*apoplexie utéro-placentaire*) observed by Couvelaire and other authors are probably characteristic of the eclamptic form of accidental hæmorrhage." In America these advances in our knowledge seem to have attracted no attention until Williams, in 1915, reported the findings in the uterine wall in two of his cases and reviewed the literature. The pathological picture noted by him was essentially the same as that described by Couvelaire, and he, also, concluded that the lesions present were toxic in origin. Since this date case reports and articles on this subject have been accumulating with increasing rapidity. Thus, Williams, in 1915, collected about 20 cases; Ahlström, in 1919, 43 cases; and Willson, in 1921, 69 cases.

NOMENCLATURE

Kolisko, 1903, designated this condition hæmorrhagic infarction of the uterus (*infarctus hæmorrhagicus uteri*). Couvelaire,

[1] Read before the Medical Society of the District of Columbia, April 27, 1921.

1911, suggested the term uteroplacental apoplexy (*apoplexie utéro-placentaire*). Williams, 1915, stated that neither of these terms seemed to describe the condition accurately but that he was not prepared to suggest a better one. FitzGibbon, 1918, proposed the term antepartum toxæmic hæmorrhage.

SCOPE OF PAPER

In this paper, in addition to reporting a case of my own, I wish to present an intensive study of the clinical and pathological data of all the cases in the literature to this date. It is hoped that the examination of these data, here brought together for the first time, will serve to give a composite picture of the condition sufficiently accurate and authoritative to justify drawing more or less definite conclusions regarding its etiology and pathogenesis; its relation to accidental hæmorrhage and the other toxæmias of pregnancy; and its diagnosis, prognosis, and treatment. In Table I the clinical data of 69 cases are assembled. The cases are arranged and numbered in the order of their publication. In Table II the pathological data of 46 cases observed at laparotomy or autopsy are assembled. The case numbers in this table correspond to those in Table I, the omitted cases being those in which there are no other pathological data reported except the presence of subserous ecchymosis and hæmorrhagic infiltration of the uterine wall.

REPORT OF A CASE

My own case is as follows:

N. D., age 37, illegitimately pregnant for the first time, was admitted to the Riggs Building of the Georgetown University Hospital at 3 a.m. November 9, 1915, from the Florence Crittenton Mission. The following history was obtained: She had been admitted to the Mission on September 17. Upon examination on the 19th, it was found that her family and previous history were negative. She had menstruated first at 14 years of age. The last period had begun on February 15, 1915. The date of impregnation and quickening were unknown. At this time the fundus was three fingers' breadths above the umbilicus. The presentation was transverse. The fœtal heart was heard in the right lower quadrant. The pelvic measurements were, bispinous, 24 centimeters; bicristal, 26.5 centimeters; bitrochanteric, 31 centimeters, and the external conjugate, 19 centimeters. The limbs were œdematous and the urine contained albumin. The blood pressure was not taken. Under appropriate treatment the œdema cleared up, the albumin disappeared from the urine and none was found at the examinations made during the last 3 weeks before labor. Full term was estimated for November 22, 1915.

Labor began at 9:30 on the evening of November 8, at the estimated thirty-eighth week of pregnancy. The pains were severe and every 4 or 5 minutes from the first. After lasting for about 2 hours there began to be some bleeding from the vagina and the patient was nauseated and vomited at frequent intervals. She complained of great pain and tenderness in the abdomen and of feeling very bad. These symptoms continuing, she was sent to the hospital. Upon admission to the hospital the pulse was 106, temperature 97°, respiration 22. The patient looked very ill. The expression was anxious, marked pallor with a bluish tinge to the lips, cold, clammy perspiration—in a word the typical picture of serious shock and hæmorrhage. There was fairly free bleeding from the vagina. The abdomen was very tender, the uterus was of a ligneous consistency and did not relax. Palpation of the fœtus was almost impossible, but the head was made out at the pelvic brim. The fœtal heart could not be heard. Vaginal examination disclosed the cervix dilated to admit one finger and not taken up. No placental tissue could be felt.

Diagnosis: Premature separation of a normally situated placenta with combined external and concealed bleeding. Fœtus dead.

In view of the fact that the patient was an elderly primipara, with an undilated cervix and losing blood rather freely, it was thought that immediate delivery was imperative and that cæsarean section was the most conservative method of accomplishing it. Five hundred cubic centimeters of salt solution were given by rectum and retained. Operation under ether anæsthesia. Iodine preparation. Ergotole and pituitrin were given hypodermically at the beginning of the operation. The abdomen was opened by an incision in the median line above and below the umbilicus. There was a considerable quantity of blood-stained serum in the peritoneal cavity. The uterus presented such a peculiar appearance that it was delivered from the abdomen to permit of closer inspection. The whole organ had a mottled, ecchymotic look, the colors ranging from that of the normal organ through blue to almost black. The discoloration was greater in the region of the left cornua. Both the anterior and posterior walls were involved. In addition to the discoloration a peculiar fissured appearance was noted. The fissures seemed to run, in the main, parallel with the long axis of the organ. The peritoneum did not seem to be torn through; the effect was more as though the superficial layers of muscle had been torn subperitoneally. The tubes and ovaries were apparently normal. Upon incision of the uterus the placenta was found attached to the left side of the anterior uterine wall and separated for about one-third of its surface. The uterus con-

tained over a quart of fluid and clotted blood. The female fœtus was dead and was removed in the intact membranes. The cord was wrapped twice around the neck and the amniotic fluid was stained with meconium but not with blood. There was some question as to the proper course to pursue in regard to leaving or removing the uterus; its appearance was most abnormal and at first it failed to contract well. After massage and the application of hot towels the contraction was more satisfactory and it was finally closed by interrupted sutures, a gauze pack having been first introduced with one end carried down into the vagina. One thousand cubic centimeters of salt solution were given by hypodermoclysis during the operation.

The patient returned to the ward with a pulse of 136 and reacted quickly. Her condition remained thoroughly unsatisfactory, however, and despite all the usual treatment she died about 3 hours after the operation.

Autopsy by Dr. Lester Neuman. Section made 12 hours postmortem. Body of a female over 30 years of age. Rigor mortis fairly well marked in all extremities. Inspection shows enlarged breasts, with pigmented areolæ, a recent median abdominal incision and the two points of entry for hypodermoclysis. The heart, lungs, and thoracic aorta are apparently normal. The abdominal cavity contains about 500 cubic centimeters of bloody fluid. The liver is pale and reduced in consistency. The gallbladder is apparently normal. The spleen is reduced in consistency. The stomach and intestines, aside from being pale, are apparently normal. The kidneys are pale and reduced in consistency. The urinary bladder is distended with urine.

The fallopian tubes and ovaries are apparently normal. The uterus is very much enlarged and shows a recent median incision on the anterior surface. There are present subperitoneal hæmorrhages over the entire uterus and the broad ligament of the left side. The uterine wall is very soft and the bundles of muscular fibers appear to be separated by considerable spaces. The cavity of the uterus is packed with gauze and shows no sign of hæmorrhage.

Anatomical diagnosis. While no exact anatomical diagnosis can be made, the pale and soft condition of the various organs and the presence of a considerable quantity of bloody fluid in the abdominal cavity, plainly indicate a marked anæmia, which undoubtedly was an important contributory factor in the clinical diagnosis of shock.

Microscopical examination. There is a central necrosis of the lobules of the liver, showing especially a slight biliary pigmentation and slight fatty degeneration. The kidneys show acute parenchymatous degeneration of a marked degree, involving especially the convoluted tubules. The uterine musculature appears normal with the exception of marked hæmorrhagic extravasations between the bundles of muscle fibers. The placenta is apparently normal with the exception of a slightly hyaline appearance of the stroma of the villi.

SUMMARY OF THE CLINICAL DATA IN TABLE I

Age. This was mentioned in 59 cases. The youngest patient was 17, the oldest 42, and the average age was 32.2 years.

Parity. This was given in 67 cases. Of these 18 were I-paræ; 1, II-para; 6, III-paræ; 5, IV-paræ; 5, V-paræ; 5, VI-paræ; 4, VII-paræ; 5, VIII-paræ; 5, IX-paræ; 2, X-paræ; 1, XI-para; 5, XIII-paræ; 1, XIV-para; and 4 were stated to be multiparæ. Of the 67 cases, therefore, 26.8 per cent were primiparæ, 73.1 per cent multiparæ, and the average parity was 5.3.

Period of gestation. This was mentioned, more or less definitely, in 58 cases. Some authors refer to calendar and some to lunar months. As near as could be determined, however, the condition developed at the following periods, in the number of cases indicated: In the seventh month, 5 cases; in the eighth month, 10 cases; in the ninth month, 21 cases, and in the tenth month and at term, 22 cases.

Symptoms of toxæmia. The condition of the urine was mentioned in 51 cases. It was stated to have been normal in 7 cases. Albumin was present in quantities varying from a trace to an amount sufficient to justify the terms "loaded" and "solid" in 44 cases. It was therefore present in 86.2 per cent of the cases. Casts were noted in 12 cases, always in association with albumin. Blood was mentioned in several cases but it was not always possible to determine whether catheterized specimens were referred to.

It is surprising to note that, although the majority of the cases are only recently reported, the blood pressure was mentioned in only 9 cases. The maximum systolic pressure readings in these cases were 100, 120, 160, 170, 174, 180, 200, 260, and 280, the average being 182.

Various other clinical manifestations of toxæmia were noted. Jaundice was noted in 1 case; œdema in 12 cases; headache in 7 cases; vomiting throughout pregnancy in 1 case; and visual disturbances in 6 cases, 1 case having albuminuric retinitis, and 2 patients being blind. Eclampsia was present in 6 cases.

In 55 cases in which something definite is said regarding the presence or absence of clinical evidence of toxæmia, the condition of the patient indicates its absence in 7 cases and its presence in 48 cases; in other words, toxæmia is indicated clinically in 87.2 per cent of the cases. If here are added 2 cases in which distinct hepatic or renal lesions of a toxic nature were noted at autopsy although clinical evidence of toxæmia is not mentioned, the figures become 7 cases without evidence of toxæmia, and 50 with such evidence, or 87.7 per cent of 57 cases showing clinical or pathological evidence of toxæmia.

Character of bleeding. It is difficult to draw a sharp line of distinction between the cases of frank and concealed hæmorrhage because in the majority of instances there is at least an escape of blood-stained serum from the vagina. However, in 67 cases in which this point could be more or less

TABLE I.—CLINICAL DATA OF SIXTY-NINE CASES

Case Number	Reporter	Patient			Symptoms of Toxæmia			Result		Character of Bleeding	Degree of Separation	Method of Delivery	Remarks
		Parity	Age	Month of Pregnancy	Urine	Blood Pressure	Miscellaneous	Mother	Fœtus				
1	Desmond	XIV.	42	8				Died	Died	Concealed	Complete	None	Died undelivered
2	v. Weiss	III.	27	9	No albumin			Died	Died	Combined	Complete	Version and extraction	Death due to postpartum hæmorrhage
3	Knauer	VII.	35	7				Died	Died	Combined	Complete	Version and extraction	Ecchymoses on legs
4	Seitz	I.	17	9			Eclampsia	Died	Died	Combined	Partial	None	Died undelivered
5	Targett	VIII.	34	6	Albumin present		Œdema of legs	Recovered	Died	Combined	Complete	Porro	
6	LeLorier	III.	26	9	No albumin		General health good	Recovered	Died	Concealed	Complete	Cæsarean section	Uterus made to contract with difficulty
7	Bar and Kervily	VI.		7			Previous good health	Died	Died	Combined		Cæsarean section	
8	Pulvirenti	I.	30	7	Much albumin and hyaline and granular casts		Chronic nephritis	Died	Died	Concealed	Complete	Hysterectomy without opening the uterus	
9	Keyworth	VIII.	34	9				Died	Died	Combined	Partial	Spontaneous	Persistent oozing from lacerations of the vulva
10	Kerr	IV.						Died	Died	Combined		Porro	
11	Couvelaire	I.	26	9	Considerable albumin	200	Œdema of legs, headache, visual symptoms and albuminuric retinitis	Recovered	Died	Concealed	Complete	Porro	
12	Couvelaire	V.	35	9	Operative specimen contained albumin		Vomiting throughout pregnancy, headache, œdema, and visual disturbances	Died	Died	Combined	Complete	Porro	
13	Couvelaire	I.	23	8	Albumin present	280	Eclampsia	Died	Died	Concealed		Spontaneous delivery	Renal decapsulation. Eye grounds and lumbar fluid negative
14	Zweifel	III.	26	9	Considerable albumin			Recovered	Died	Combined	Complete	Hysterectomy without opening the uterus	
15	Berggren	IV.	37	9	Much albumin, hyaline and granular casts, and renal epithelium			Recovered	Recovered	Combined	Complete	Cæsarean section	
16	Kynoch	IX.		9				Died	Died	Concealed	Partial	None	Died undelivered
17	Fieux	Multipara			Albumin present			Died	Died			Version and extraction	Death due to postpartum hæmorrhage

18	Fabre and Bourret	VI.		0			Pregnancy had been normal	Died	Died	Combined		Manual dilatation of cervix and craniotomy	Syphilis
19	Bar							Died				Extraction of fœtus	
20	Spaeth	I	28					Recovered	Recovered	Combined	Partial	Cæsarean section	
21	Jentter	Muitipara	32				General œdema	Died	Died	Combined		Porro	Uterus failed to contract
22	Essen-Moeller	V.	31	9	Albumin and casts			Died	Died	Combined	Partial	Version and extraction	Death from tear of cervix and hæmorrhage
23	Essen-Moeller	IV.	37	9	Albumin and casts			Recovered	Recovered	Combined	Partial	Cæsarean section	Baby died in a few days from a cardiac deformity
24	Essen-Moeller	V.	31	7	A little albumin			Recovered	Died	Combined		Cæsarean section	Grone's case
25	Essen-Moeller	I.	21	9	Much albumin			Recovered	Died	Concealed	Partial	Cæsarean section	
26	Essen-Moeller	I.	17	7	Albumin			Recovered	Died	Combined		Cæsarean section	Grone's case
27	King	V.	36	8	Trace of albumin			Recovered	Died	Combined	Complete	Porro	Wassermann negative
28	Shaw	XIII.	40	9	Loaded with albumin			Died	Died	Combined		Spontaneous delivery	Hysterectomy for postpartum hæmorrhage. Right ureter ligated at operation
29	Clifford	II.	25	9	Solid with albumin			Died	Died	Combined	Complete	Porro	
30	Zarate	Multipara		8			Eclampsia	Died	Died	Concealed	Complete	Manual dilatation and craniotomy	
31	Zarate	Multipara	36		Thick ring of albumin		Eclampsia. Œdema of legs	Died	Died	Concealed	Complete	Spontaneous delivery	Hysterectomy for postpartum hæmorrhage. Death on table
32	Fraipont	VIII.	37	9	No albumin		No œdema	Died	Died	Combined	Complete	Version and extraction	Postpartum hæmorrhage contributed to death
33	Brandt	I.	30		Albumin present			Recovered	Recovered	Combined		Cæsarean section	
34	Williams	I.	24	8	Normal			Recovered	Died	Concealed	Complete	Porro	
35	Williams	I.	18	9	Albumin and granular casts	100		Recovered	Died	Combined	Complete	Porro	
36	Brandt	XIII.	42	9	Albumin present			Died	Died	Combined		Vaginal hysterotomy	Hysterectomy for postpartum hæmorrhage

TABLE I. —CLINICAL DATA OF SIXTY-NINE CASES—*Continued*

Case Number	Reporter	Patient			Symptoms of Toxæmia			Result		Character of Bleeding	Degree of Separation	Method of Delivery	Remarks
		Parity	Age	Month of Pregnancy	Urine	Blood Pressure	Miscellaneous	Mother	Fœtus				
37	v. Franque	IV.	29					Re-cov-ered	Died	Combined	Complete	Hysterectomy without opening the uterus	
38	Oldfield and Hann	I.	38	8	Loaded with albumin. Blood in catheterized specimen		Œdema of feet and face, headache and almost complete blindness	Re-cov-ered	Died	Combined	Complete	Porro	Toxic state lasted about 2 weeks after delivery
39	Shaw	VII.	41	7	Considerable albumin			Re-cov-ered	Died	Combined	Complete	Porro	
40	Shaw	XI.	38	8	Considerable albumin			Died	Died	Concealed	Complete	Porro	
41	Shaw	IX.	32	8	Large amount of albumin			Re-cov-ered	Died	Combined	Complete	Porro	
42	Shaw	IX.	41	7	Large amount of albumin			Re-cov-ered	Died	Combined	Complete	Porro	
43	Shaw	XIII.	39	8	Large amount of albumin			Died	Died	Combined	Complete	Porro	Death due to slipping of ligature on uterine artery
44	Spencer							Re-cov-ered		Concealed		Cæsarean section	
45	Smith	X.		9				Died	Died	Combined		Hysterectomy without opening the uterus	
46	McNair	VI.	34	8	Trace of albumin			Died	Died	Concealed	Complete	Manual dilatation, craniotomy	
47	Huntington	I.	25	6	Solid with albumin	170	Jaundice	Died	Died	Combined		Cæsarean section	Death due to peritonitis
48	Mazzini	I.	22	6	No albumin		No œdema	Re-cov-ered	Died	Concealed	Partial	Excision of uterine horn	Uterus didelphys. Pregnant horn rotated 180 degrees
49	Hillis	I.	35	9	Slight amount of albumin, no casts	120		Re-cov-ered	Re-cov-ered	Combined		Cæsarean section	Uterus made to contract with difficulty. Blow on abdomen 4 days before attack
50	Wing	I.	22	8				Re-cov-ered	Died	Combined	Partial	Cæsarean section	Fell, striking abdomen, about 3 hours before pains began
51	Morse	VIII.	39	8	Trace of albumin, no casts		Pregnancy normal except for nausea and constipation	Re-cov-ered	Died	Concealed	Complete	Porro	

52	Morse	XIII.	40	8	Heavy trace of albumin and casts	160		Died	Died	Combined	Partial	Porro	Nephritic toxæmia in preceding pregnancy. Death due to pneumonia
53	Grone	X.	33	7	Albumin present		None	Recovered	Died	Combined		Porro	Accidental hæmorrhage in ninth pregnancy
54	Smyly	III.	30		Loaded with albumin, and hyaline and granular casts			Recovered	Died	Concealed	Complete	Cæsarean section	
55	Smyly	IX.	39	9	Albumin, blood and casts	260	Headache and impaired vision	Recovered	Died	Concealed	Complete	Cæsarean section	Patient toxic for 4 weeks before attack. Ecchymosis on left buttock
56	Ahlström	V.	29	6	Albumin present		Œdema of face and legs for 3 months	Died	Died	Combined		Vaginal hysterotomy	Postpartum hæmorrhage caused death
57	Ahlström	VIII.	39	9				Died	Died	Combined		Version and extraction	Postpartum hæmorrhage caused death
58	Ahlström	III.	33	9	Normal			Died	Died	Combined	Complete	Bossi dilator and craniotomy	Postpartum hæmorrhage caused death
59	Vogt	IV.	34	7			Eclampsia	Died	Died	Concealed	Partial	Cæsarean section	
60	Quigley	VI.	33		Albumin present	174	Headache, œdema and visual disturbance	Recovered	Died	Combined		Cæsarean section	Toxæmia, short cord, and fall
61	Lieven	VII.	35	9	No albumin			Died	Died	Combined	Complete	Version and extraction	Death due to postpartum hæmorrhage
62	Harrison	I.	26	8	Distinct trace of albumin		Œdema of legs	Recovered	Died	Combined	Complete	Cæsarean section	
63	Ley	IX.	41	9	Thick cloud of albumin and granular casts		None. Well until day of attack	Died	Died	Combined	Complete	Manual dilatation of cervix, rupture of membranes, vaginal plug, 1 ampoule of pituitrin, finally delivered with forceps	Hysterectomy for rupture of the uterus
64	Ley	XIII.	40	8	Albumin, hyaline and granular casts		None. Well until day of attack	Died	Died	Combined	Complete	Porro	
65	Ley	VII.	37	9	Much albumin, hyaline and granular casts		Frontal headache preceded attack for 24 hours	Died	Died	Concealed	Complete	Porro	
66	Ley	VI.	32	9	Albumin present		Œdema of legs and fainting attacks for 2 days	Recovered	Died	Concealed	Complete	Cæsarean section	Uterus relaxed at first but finally contracted well. Wassermann negative
67	Fordyce and Johnstone	I.		9	Large amount of albumin. Suppression		Eclampsia. Œdema of trunk and limbs	Died	Died	Combined	Partial	Porro	
68	Snowden	III.	37	7	Albumin and hyaline and granular casts	180	Œdema of face and feet, headache, amaurosis	Recovered	Died	Concealed	Complete	Cæsarean section	Bleeding for several days from the abdominal incision
69	Willson	I.	37	9	Albumin had been present previously but not at time of attack			Died	Died	Combined	Partial	Cæsarean section	

accurately determined, I have classified 46 cases in the frank or combined type, 68.6 per cent of the cases, therefore, having frank bleeding.

Degree of placental separation. In 48 cases in which this point could be determined, the separation was complete in 36 cases, and partial in 12 cases.

Method of delivery. The Porro operation was performed 21 times; conservative cæsarean section 21 times; abdominal hysterectomy without opening the uterus 4 times; vaginal hysterotomy 2 times; abdominal hysterectomy for rupture of the uterus once; excision of the pregnant horn of a uterus didelphys once; extraction of the fœtus 12 times (forceps, craniotomy, version and extraction); spontaneous delivery occurred in 4 cases; abdominal hysterectomy to control postpartum hæmorrhage was done 3 times; 3 patients died undelivered.

Mortality. There were 38 maternal deaths in 69 cases, a mortality rate for the whole series of 55 per cent. There were 62 fœtal deaths in 67 cases, a mortality rate of 92.5 per cent. This series of cases, however, includes only cases of accidental hæmorrhage associated with hæmorrhagic infarction of the uterus. The diagnosis, therefore, was only possible either at autopsy or laparotomy, and hence it becomes necessary in figuring the mortality rate to eliminate all cases in which the diagnosis was established postmortem. Doing this we find 19 maternal deaths in 50 cases in which the diagnosis was established during life by means of a laparotomy, a mortality of 38 per cent. The five children which survived were all delivered by cæsarean section, there being no case in which the fœtus survived delivery through the vagina.

The maternal mortality rates for the various methods of delivery were as follows: For the Porro operation, 10 deaths in 21 cases, a rate of 47.6 per cent; for conservative cæsarean section, 4 deaths in 21 cases, a rate of 19 per cent; for hysterectomy without opening the uterus, 2 deaths in 4 cases, a rate of 50 per cent; the case of hysterectomy for uterine rupture resulted fatally, as did the 3 cases of hysterectomy for postpartum hæmorrhage.

Miscellaneous observations. The Wassermann reaction in 2 cases in which it was mentioned was negative. One patient was syphilitic. Ecchymoses in the skin were present in 2 cases, a large ecchymosis on the left buttock in 1 case, and an ecchymotic mottling of the legs in another. Peritonitis is stated to have caused death in 1 case, following cæsarean section. Slipping of a ligature on the uterine artery following a Porro operation caused another. The right ureter was ligated in 1 case in which hysterectomy was necessary to control postpartum hæmorrhage. Death was attributed to an acute exacerbation of a chronic colitis, however. Postpartum hæmorrhage caused death in 11 cases, all delivered through the vagina, but does not seem to have contributed to the death of any patient on whom conservative cæsarean section had been performed.

SUMMARY OF PATHOLOGICAL DATA IN TABLE II

Macroscopical appearance of the uterus. At autopsy or laparotomy the uterus presents a very striking picture, its appearance being compared by many to that of an ovarian cyst with a twisted pedicle. The whole organ may be almost black or mottled throughout from the presence of the effused blood in its walls or under the peritoneum, or one lateral half or the anterior or posterior surface may appear normal and the opposite portion show the characteristic discoloration.

The myometrium. As might be expected, the extent of the hæmorrhagic infiltration of the uterine musculature varies greatly. Subperitoneal ecchymosis due to extravasation of blood under the peritoneum seems to be present in all cases, and in a few is the only lesion noted. Between such cases as these and those in which the whole uterine wall is literally inundated with blood, all stages in the process are encountered. The hæmorrhage constantly tends toward separating and tearing apart the muscle bundles, but it is only in the areas where it is most intense that the individual fibers are separated from each other. This rarely occurs. In such localities the muscle bundles may be seen occasionally as strands of tissue traversing great lakes of effused blood. Œdema is very frequently noted, and areas free from hæmorrhage often show much œdematous infiltration. Increase in the amount of connective tissue is noted occasionally. Round-celled infiltration around some of the hæmorrhagic foci has been noted, and also the presence of leucocytes containing blood pigment. Such areas probably indicate that successive effusions of blood occur, some older and some more recent.

The distribution of the hæmorrhage in the uterine wall is interesting and, from an etiological point of view, most suggestive. The process is always worse in the region of the fundus and upper part of the body, and the lower uterine segment seems to be frequently entirely spared. In the great majority of the cases the area of the uterine wall over the site of the placenta is the most involved and the extravasation is usually worse on the anterior, posterior, or lateral aspect of the uterus, depending upon the location of the placenta. Another striking finding is the tendency of the hæmorrhagic process to reach its acme under the peritoneum. There are a few exceptions to this, but the great majority of the observers note particularly and specifically that it is the outermost layers of the myometrium which show the densest and deepest discoloration from the bloody effusion. In this connection it should also be remembered that in the milder cases the lesion may be limited to subserous ecchymoses. Even over the area of placental attachment the layers of musculature adjacent to the decidua may show only punctiform bleedings, which increase as the peritoneum is approached until the outermost third of the thickness of the uterine wall is literally torn asunder by a massive and brutal hæmorrhage.

This is illustrated most strikingly in the colored plate of Fordyce and Johnstone, showing a cross section of the uterus through the placental site at a level just below the tubal insertions.

The observations regarding the condition of the muscle fibers themselves are rather contradictory. In 14 cases in which this point is mentioned they are stated to have been normal or healthy in 7 cases and abnormal in 7 cases. The most detailed study of the muscle fibers was made by Ley. He found marked degeneration present in 3 uteri studied. This seemed to be more marked in regions where the hæmorrhage was greatest, but was not limited to such areas, and, in his opinion, was not secondary to the hæmorrhage but was due to the same cause, namely the action of a toxin. The process was severe enough in some areas to reduce the muscle bundles to a "vacuolated matrix in which lie a very few tortuous, narrow, hyper- and hypo-chromatic nuclei." The individual fibers is such areas could not be recognized.

The decidua. The changes in the decidua are always worse in the decidua basalis than in the parietal decidua. Hæmorrhage is the most marked lesion and is extensive enough in a few cases to cause complete disorganization. Degeneration and necrosis of the decidual cells has been noted. The decidual vessels show congestion. In the case of Young (the specimen of the case reported clinically by Kynoch) it is stated that the decidual vessels were dilated into enormous thin-walled sinuses. Ley mentions a partial closing of the decidual vessels by proliferation of the intima in one case, and some perivascular infiltration in another. Inflammatory lesions were not noted in any case and their absence was noted specifically in a few cases.

The blood vessels. Congestion, particularly of the veins, is quite uniformly present. Thrombosis of the veins in the uterine wall, particularly in the neighborhood of the placental site, is noted in several cases. Couvelaire and Williams noted solutions in the continuity of the walls of some veins communicating with the areas of effusion. Williams and Morse noted changes of an endarteritic nature in the walls of the smaller arteries, but the latter states that these did not differ from those usually encountered in the uteri of multiparous patients. Mazzini noted thrombosis in some vessels and a homogeneous appearance in the walls of others. Young states that: " . . . a massive, extensive, and fairly old standing thrombosis was found in the ovarian vessels on each side, especially the left. The uterine vessels seem to be healthy." Perivascular infiltration was noted by Ley, who also states that the changes in the vessel walls did not seem to differ from those noted in the surrounding tissues. Berggren, v. Weiss, Fraipont, Couvelaire, Essen-Moeller and Ahlström, all note the vessel walls as being normal.

The peritoneum. The presence of subperitoneal hæmorrhagic effusion in all cases has already been noted. The most striking lesion in the peritoneum, however, and one of great importance from both a clinical and pathological point of view, is the presence in many cases of fissures or ruptures in the peritoneum, extending occasionally to the depth of a few millimeters into the subjacent muscularis. These are noted in 11 cases. (Essen-Moeller, Fraipont, King, Knauer, LeLorier, Ley, McNair, Shaw, Smith, Smyly, and Zweifel.) This represents an incidence of approximately 15 per cent. They may be single or multiple. Their direction is usually transverse, but they may also be directed in the long axis of the uterus, or have an irregular arrangement. Their position is usually on the anterior or posterior wall in the region of the fundus. It is very probable that they occur, in most instances, directly over the placental site, and such a location is definitely shown in 3 cases. I have not included in this series several cases in the literature in which these peritoneal fissures have been noted in association with accidental hæmorrhage but in which nothing is said regarding hæmorrhage into the uterine wall. There would seem to be little doubt, however, that these belong to the type of condition under discussion. Such cases are reported by White, Shannon, Macirone, and Werner. The case of White is particularly interesting because it is, in all probability, the first case of uteroplacental apoplexy in the literature. The patient, a 32-year-old IX-para, died about an hour after the delivery of a stillborn fœtus. Nothing is said about external or concealed hæmorrhage but autopsy showed the characteristic peritoneal lacerations, hæmorrhagic extravasations into the broad ligaments, and intra-abdominal bleeding. This case was reported in 1834.

Intraperitoneal effusion. In 31 cases in which this point is mentioned the presence of an intraperitoneal effusion is noted in 22 cases, an incidence of 71 per cent. The character of the effusion varied from a clear serum to pure blood. The amount varied from a slightly increased quantity of peritoneal fluid to an intra-abdominal hæmorrhage quite comparable to that caused by a ruptured ectopic pregnancy. In the majority of the cases the source of the bleeding is evidently the superficial lacerations described above. In one case it came from ruptured vessels in the broad ligament, in another is believed to have come from the wall of the tubes, and in still another was at least contributed to by complete rupture of the uterus. The cases with bloody serum frequently showed no peritoneal tears, the opposite being true when free blood was present.

The adnexa. Not the least interesting feature of the pathology is the participation of the tubes, ovaries, and uterine ligaments in the hæmorrhagic process. The broad ligaments were involved in 26 cases, the tubes in 11 cases, the ovaries in 4 cases, and the round ligaments, once. These were, of course, associated in various combinations. The lesion in the ovary was usually simply the presence of punctiform hæmorrhage. In one of Williams' cases this was extensive enough, however, entirely to isolate some graafian follicles in a bloody effusion. Punctiform hæmorrhage in the tubal wall was the

TABLE II.—PATHOLOGICAL DATA IN FORTY-SIX CASES

(Case numbers in this table correspond with those in Table I.)

Case No.	Infiltration of the Uterine Wall	Muscle Fibers	Decidua	Blood Vessels	Peritoneal Lacerations	Adnexa	Intraperitoneal Effusion	Other Organs
2	Marked ecchymosis at the fundus. Round-celled infiltration around some of the hæmorrhagic areas			Walls normal in appearance		Broad ligaments infiltrated. Right tube filled with blood	Blood and serous fluid	
3	Bloody effusions under the serosa				On posterior surface in long axis of uterus	Effusions in broad ligaments	Free blood	Chronic nephritis. Hæmorrhagic hepatitis
4	Small hæmorrhages between the muscle bundles toward the decidua		Cellular degeneration and hæmorrhage	Normal				Kidneys: parenchymatous nephritis and œdema. Liver: necrosis and hæmorrhage. Pulmonary tuberculosis. Hæmorrhage in membranes of brain
6	Worse under the peritoneum	Healthy			One tear about 2 cm. long over placental site			
7	Uterine wall appeared ecchymotic						No blood or bloody serum	Kidneys: chronic parenchymatous nephritis. Liver: central necrosis, advanced grade
8	Numerous punctiform hæmorrhages and subserous effusions							Hepatic cirrhosis and chronic nephritis
9	Irregular subperitoneal "bruising," chiefly around the cornua					Large extravasation in left broad ligament. Both tubes contained blood	15 ounces of free and clotted blood	One small hæmorrhage on the convexity of diaphragm, another on the visceral pericardium
11	Marked throughout. Much worse in area of placental attachment, where all layers are involved. Elsewhere worse in middle and superficial layers. The muscle bundles are separated and even individual fibers disassociated		Parietal, normal; basalis, unrecognizable because of hæmorrhagic infiltration	Large and congested but intact, with their walls and endotheliun normal		Punctiform hæmorrhages in walls both tubes and in both ovaries. Both broad ligaments infiltrated		Fœtus: Macroscopical examination showed hæmorrhagic effusions into the liver, kidneys, adrenals, and cerebral meninges
12	Limited to the placental site. Œdema	Appear normal		Walls of some veins have given way. Those of the arteries intact and normal. Some perivascular infiltration		Discrete ecchymoses in both broad ligaments		
13	Worse at the placental site. Wall involved to a depth of 1 cm. below the peritoneum. Lower uterine segment not involved. No œdema			No changes in the vessel walls		Ovaries and left tube normal. Right tube and broad ligament infiltrated	Slight bloody effusion in the cul-de-sac	Parenchymatous degenerative lesions in kidneys. Liver normal on gross and microscopical examination
14	Ecchymosis				On posterior surface of fundus		Blood and bloody serum	

15	Muscle bundles disorganized by œdema and hæmorrhage			Polymorphonuclear leucocytosis present in abundance in some vessels, but the structure of the walls is normal. No inflammatory reaction			Free blood	
16	Œdema. Hæmorrhagic leakage through vessel walls. Infiltration worse at placental site	No evidence of degeneration anywhere	Expansion of the vessels into enormous thin walled sinuses. Here and there areas show hæmorrhage. Changes most marked in the basalis	Congestion of those in the uterine wall, otherwise healthy.. Massive, extensive and fairly old standing thrombosis of the ovarian veins, especially the left				
22	Present				Present			
27	Marked throughout, from decidua to the peritoneum. Œdema. Occasional collections of leucocytes in greater numbers than can be accounted for by the effused blood	Appear degenerated; nuclei stain poorly			Slight abrasion on posterior surface involving peritoneum only	Large hæmatoma in left broad ligament, extending up behind the sigmoid	No free blood present	
28	Free blood among the muscle bundles. Large amount of fibrous tissue but no increase in amount of elastic tissue				Present, on posterior surface	Both broad ligaments swollen and infiltrated, large hæmatoma in the right. Infiltration extends up behind the cæcum	½ pint of free unclotted blood	Kidneys normal on gross and microscopical examination
29	Present					Ruptured veins in right broad ligament source of free blood	Large amount of free blood	
31	Both recent and old hæmorrhagic extravasations; some proliferation of connective tissue; some round celled infiltration	Many fibers show degeneration	Areas of hæmorrhage				100 grams of extravasated blood in cul-de-sac	
32	Marked throughout all layers, especially at the placental site	No degeneration		No visible alterations of the walls	2 transverse fissures on posterior surface of fundus, directly over placental site, extending a few millimeters into the muscularis		1 litre of blood	No lesions in lungs, liver, spleen, kidneys, or intestines on gross examination
33	Present					Broad ligaments infiltrated		
34	Worse on posterior wall and right side; placenta on posterior wall		Normal; no trace of inflammation	Free hæmorrhages in the walls of many veins communicating with the effusions. Thrombosis of the smaller veins. Degenerative changes in the walls of smaller arterioles. Main trunks of the vessels normal	None	Right broad ligament and lateral two-thirds of tube infiltrated	No free blood	Placenta normal

TABLE II. PATHOLOGICAL DATA IN FORTY-SIX CASES—*Continued.*

Case No.	Infiltration of the Uterine Wall	Muscle Fibers	Decidua	Blood Vessels	Peritoneal Lacerations	Adnexa	Intraperitoneal Effusion	Other Organs
35	Œdema. Hæmorrhage not apparently connected with larger vessels. None in outer half		No inflammatory changes; some small hæmorrhagic areas	Superficial veins distended. Veins near the placental site filled with thrombi. Degenerative changes in the walls of smaller arterioles. Main uterine and ovarian vessels normal	None	Right broad ligament, tube and ovary infiltrated	Quantity of clear serous fluid	Placenta normal
38	Patchy effusions under peritoneum. Cut surface black from effused blood	Disassociated				Tubes, ovaries, and broad ligaments all involved. Ecchymoses extend onto bladder in front and up behind cæcum on right and sigmoid on left		Placenta normal. Fœtus: chocolate colored intestines, bloody effusions under peritoneum and bloody serum in the peritoneal cavity
39	Hæmorrhage under peritoneum and in superficial layers of the myometrium					Large hæmatoma in left broad ligament; none in right	½ pint of free blood	
40	Hæmorrhage under peritoneum and in superficial layers of the myometrium					Both broad ligaments enormously distended with large hæmatoma	No free blood	
41	Hæmorrhage under peritoneum and in superficial layers of the myometrium					Very large hæmatoma in left broad ligament and smaller in right	No free blood	
42	Hæmorrhage under peritoneum and in superficial layers of the myometrium					Large hæmatoma in right broad ligament, none in left		
45	Ecchymosis				2 fissures, vertical, on posterior surface of fundus		8 ounces free blood	
46	Numerous subserous hæmorrhages. Patchy distribution of infiltration. Placenta on the anterior wall	Apparently healthy			Numerous on anterior surface, directly over placental site. Some extend into muscularis		24 ounces of free blood	Anæmic but apparently free from disease
47	Ecchymosis							Acute toxic degeneration of the liver, no normal liver tissue left
48	Present	Uniform degeneration		Thrombosis of some vessels; walls of others present homogenous appearance; congestion of the subserous vessels		Punctiform hæmorrhages in left tube and ovary. Left broad ligament infiltrated		Torsion of left horn of a uterus didelphys 180° to right

51	Worse at attachment of broad ligaments to fundus. Infiltration extends to a depth of 0.5 to 1 cm. beneath the peritoneum. Worse on anterior wall while placenta was on posterior wall. Œdema. Hæmorrhage from capillaries. Inner layers of myometrium normal	Disassociated	Numerous hæmorrhages into basalis. No leucocytic infiltration	Uterine and ovarian vessels normal in appearance and not thrombosed. Thrombosis of several veins in uterine wall at placental site. Arterioles show degeneration and thickening of subendothelial tissues		Tubes and ovaries not involved. Upper and median portions of broad ligaments infiltrated	Small amount of serous fluid	
52	Most intense in outer half of wall. Œdema	Disassociated	No inflammatory changes	Veins engorged and diapedesis occurring. No thrombosis. Arterial changes similar to those in case 51		Tubes and ovaries not involved. Ecchymotic spots in upper portions of both broad ligaments		
54	Subperitoneal patches of effusion. Wall infiltrated throughout				Peritoneum raised in large blebs filled with blood; one had ruptured		Free blood	
56	Ecchymosis worse on right side and anterior wall; distinctly worse in superficial layers. Placenta on anterior wall. No œdema	No changes	Hæmorrhagic areas. Some areas show degeneration	Veins congested; vessel walls normal, no thrombosis of ovarian or uterine vessels	None	Ovaries normal. Both tubes, both broad ligaments, and 1 round ligament infiltrated	400 ccm. blood-stained fluid	Subcapsular hæmorrhages in liver; no necrosis. Degenerative lesions in kidneys. Numerous small subcapsular hæmorrhages in adrenals
57	Distinctly worse under peritoneum. No œdema			No changes				Subcapsular hæmorrhages in liver. Punctiform hæmorrhages in mucosa of stomach
58	Only at placental site and only to a depth of 2 to 5 mm. under the peritoneum. No œdema			No changes in vessel walls or thrombosis		Not involved	No effusion	
60	Subperitoneal ecchymosis only						About 2 pints of serosanguineous fluid	
61	Subperitoneal ecchymosis				Present	Both broad ligaments infiltrated		Generally anæmic, otherwise normal. Kidneys normal on microscopic examination
63	Marked. Œdema	Marked degeneration and necrosis at placental site and throughout the uterine wall	Basalis infiltrated with blood	Slight perivascular infiltration. Musculo-elastic hypertrophy of the intima of the larger arteries. Decidual veins partly closed by proliferation of intima		Both broad ligaments infiltrated. Tubes and ovaries normal	Large amount of free blood and clots. (Rupture of uterus)	Œdema and degeneration of kidneys. Fatty granules in liver cells, most numerous in center of lobules
64	Infiltration marked, in places worse over decidua, in others under peritoneum. Œdema	Marked degeneration and necrosis		Perivascular infiltration slight. Intimal proliferation in a few large veins. Swelling and œdema of walls of veins and arteries. Changes in vessel walls resemble those in surrounding tissues	Not present	Upper portion of left broad ligament infiltrated	Some blood stained fluid	Degenerative lesions in kidneys
65	Infiltration marked, in places worse over decidua, in others under peritoneum. Œdema	Marked degeneration and necrosis		Perivascular infiltration with lymphocytes in uterine wall and decidua			No free blood present	Severe parenchymatous degeneration of liver and kidneys. Diaphragm shows extensive hæmorrhage into lipomatous tissue beneath the pleura

TABLE II. PATHOLOGICAL DATA IN FORTY-SIX CASES—*Continued.*

Case No.	Infiltration of the Uterine Wall	Muscle Fibers	Decidua	Blood Vessels	Peritoneal Lacterations	Adenxa	Intraperitoneal Effusion	Other Organs
66	Subperitoneal hæmorrhage in regions of cornua				2 transverse lacerations on posterior surface, one involving peritoneum only, other muscularis slightly		1½ pints free blood	
67	Most marked in region of right cornua. Placenta on posterior and right lateral wall. Hæmorrhage subperitoneal in this region	All stages of degeneration in hæmorrhagic areas	Normal	Thrombosis of veins in uterine wall	None	Right broad ligament and proximal half of right tube involved	No free blood	Placenta normal except for infarcts. Liver: multiple subcapsular hæmorrhages; microscopically, hæmorrhage, necrosis and fatty degeneration. Degeneration in kidneys
68	Present				None	Tubes and broad ligaments infiltrated	None	
69	Ecchymosis worse at left cornua. Placenta attached to left side of anterior uterine wall	Appeared normal			Peculiar fissured appearance as though superficial layers of muscle had separated subperitoneally	Tubes and ovaries normal. Left broad ligament infiltrated	Considerable blood stained serum	Liver: central lobular necrosis. Kidneys: acute parenchymatous degeneration. Other organs normal. Placenta normal

usual lesion, but was occasionally extensive enough to quite disorganize it. The process in the broad ligaments varies greatly in its extent from the presence of ecchymotic spots to collections of blood which justify the term hæmatoma. The hæmorrhagic effusion may even extend beyond the broad ligaments; in one case onto the bladder, and posteriorly retroperitoneally as far as the cæcum on the right and the mesosigmoid on the left; in another case up behind the cæcum; and in a third up behind the sigmoid. The lesions in the broad ligaments, tubes, and ovaries are frequently unilateral, one side being free and the other involved, or the process is much worse on one side than on the other. Where this obtains there is distinct evidence to show that the severity of the condition is governed mainly by the location of the placental site, being worse on the side toward which the placenta tends to have its greatest area of attachment.

The placenta. With the exception of infarcts and the compressed zone corresponding to the area of the retroplacental hæmatoma, the few recorded examinations of the placenta have shown an absence of pathology. Slight thickening of the stroma of the villi was noted in a few cases.

Lesions in other organs. There are more or less complete autopsy notes in 17 cases. The lesions in the liver are hæmorrhage, usually subcapsular, and acute parenchymatous degeneration. Hæmorrhage without necrosis was present in 2 cases. Degeneration was noted 7 times and was central in 2 cases and peripheral in 1. Hepatic cirrhosis was noted once. In 1 case it is stated that no normal liver tissue was left. The liver is stated to have been normal on macroscopical examination once, and normal on both macroscopical and microscopical examination once. The usual lesion in the kidney was acute parenchymatous degeneration; this is noted 7 times. Chronic nephritis is noted twice. The kidneys were reported as normal on gross examination once, and on microscopical examination once. Hæmorrhage in the diaphragm was present twice, in the pericardium once, in the meninges once, in the mucosa of the stomach twice, and in the adrenals once. One patient had apical tuberculosis.

The fœtus. There are 2 autopsies on the fœtus reported, one by Couvelaire, and one by Oldfield and Hann. In each instance extensive hæmorrhages into various viscera were noted. Are these lesions the result of the asphyxia caused by placental separation, or are they a manifestation of the activity of the same hæmorrhagic toxin probably responsible for the similar lesions in the mother? As yet this question can not be answered. It is interesting to speculate, however, in view of recent claims that cerebral hæmorrhage in the newborn is often not of traumatic origin, but due to dyscrasias of the fœtal blood, whether a possible antenatal poisoning of the fœtus may not exist in some cases, which will enable us to trace an etiological relationship between cerebral hæmorrhage in the newborn and maternal toxæmia.

PATHOGENESIS

Clinicopathological summary. For the purpose of considering its pathogenesis, the picture of uteroplacental apoplexy detailed above may be summed up as follows: The placenta, normally located in the upper part of the uterus, is either partially or totally separated from its attachment to the uterine wall. The resulting intra-uterine bleeding may remain entirely concealed, but more frequently is manifested by external hæmorrhage. The uterine wall is the site of a hæmorrhagic extravasation, of varying extent and severity, which, however, tends to be worse in the neighborhood of the placental site and in the superficial, subperitoneal, rather than in the deeper layers. Œdema is frequently present. The muscular fibers frequently show varying degrees of degeneration, which may be very marked and extensive. The most constantly present vascular lesion is thrombosis of the smaller veins, especially back of the placental site. The decidua, particularly the decidua basalis, is the site of a hæmorrhagic infiltration and frequently shows necrosis. In about 15 per cent of the cases tears of the peritoneal coat are present. These may involve the myometrium to a depth of a few millimeters and are usually located over the placental site. Intra-abdominal bleeding from them is usually present and may be severe, or the effusion may be only a bloody serum. The broad ligaments, tubes, and ovaries are also very frequently the site of a hæmorrhagic infiltration. In about 90 per cent of the cases there is either clinical or pathological evidence of a toxæmia.

Theories regarding the causation of the lesion. The following theories have been advanced in the attempt to explain the causation of these lesions:

1. That the distention of the uterus from the intra-uterine hæmorrhage results in stretching its wall sufficiently to produce tearing of the vessels.

2. That the blood in the uterine wall is forced into it through its contraction over the intra-uterine hæmorrhage.

3. That obstruction to the venous flow from the uterus through torsion or other misplacement, or through thrombosis of the large venous trunks, results in a back pressure causing the smaller veins and capillaries to give way.

4. That the condition is the result of a toxæmia.

The first three of these hypotheses may be grouped together for consideration, as they all look toward a mechanical production of the lesions.

The mechanical theories. Morse has shown that filling the uterus of a pregnant bitch with salt solution, almost to the bursting point, will produce separation of the placentæ and abortion, but that hæmorrhage into the wall of the organ does not occur. It has already been seen, also, that the majority of cases in this series was of the frank type, and in many of these the external bleeding was not merely symptomatic but sufficient in amount to constitute a real menace to the patient, and yet in such cases the hæmorrhagic infarction has frequently been of a very severe grade. In the case of acute distention of other hollow viscera, short of actual rupture, hæmorrhage into the wall rarely occurs, and there seems to be no particular anatomical reason why the uterus should be an exception to this rule. Furthermore, the distention of the uterus in accidental hæmorrhage is rarely of the degree seen in acute hydramnios, which, so far as is known, does not cause hæmorrhage into the uterine wall.

That the hæmorrhagic infarction is not the result of the forcing of blood into the myometrium from the intra-uterine hæmorrhage is evidenced at once by a glance at the pathological picture. If this were so the infiltration should certainly be worse in the layers immediately adjacent to the decidua, instead of under the peritoneum, as is true in the great majority of the cases. Moreover, it seems difficult to believe that the attachment of the membranes to the uterine wall would resist separation more than the wall itself would resist infiltration. Hæmorrhage among muscular tissues elsewhere in the body normally searches out the lines of least resistance along the fasciæ and intermuscular septa. It seems reasonable to suppose that this is what occurs in accidental hæmorrhage, and the occurrence of frank bleeding in the majority of cases

demonstrates that a force necessary to drive the effused blood into and throughout the uterine wall, would first, and before such a point was reached, determine separation of the membranes, and external hæmorrhage, thus relieving the intra-uterine tension.

Obstruction of the venous flow from the uterus is held to be the causative factor by Young, and also by Morse; the former believes the obstruction to be due to thrombosis of the large veins; the latter looks to various malpositions of the uterus, torsional or otherwise, to cause the obstruction, and thinks the failure of the relaxed abdominal wall of the multipara to provide proper support to the uterus may be an important factor. Young's case was the only one in the series in which extensive thrombosis of the large veins was noted, and even here it was limited to the ovarian system, the uterine veins being normal. On the contrary, careful examination of the large veins, in several cases, failed to show the presence of thrombi. The experimental work of Morse on the uteri of pregnant rabbits, in so far as it can be applied to conditions in the human uterus, to my mind only serves to negative the hypothesis it is supposed to prove. He notes the fact that each horn of the rabbit's uterus is drained by three sets of veins, ovarian, mesometric, and uterovaginal. Ligation of any one, or of any two, sets of these veins resulted only in temporary congestion of the horn and did not deleteriously affect the pregnancy. When all three sets were ligated a condition was produced which clinically and pathologically corresponded to uteroplacental apoplexy. This result might have been reasonably expected, it would seem, but the further conclusion would be justifiably deducible, that such a result could be produced by nothing short of complete obstruction of the circulation. That this is true is proved by other experiments of the same authority, who found that torsion of a pregnant uterine horn in the rabbit, on the axis of the vagina, through an arc of 180 degrees, would produce placental separation but no intramural hæmorrhage. Not until the torsion had reached two complete rotations, was such a lesion produced.

The cases of Glinski, and of Mazzini, cited by Morse as corroborative clinical proof of his contention, tend, it seems to me, to further indicate its fallacy. In Mazzini's case, which I have included in this series because there was an undoubted hæmorrhagic infarction of the uterus present, the pregnant horn of a uterus didelphys was found definitely rotated through an arc of 180 degrees. In Glinski's case which I have not included because, while the uterus was congested and bled freely and the placenta was partially separated, there was no definite evidence of hæmorrhagic infiltration, there was a torsion of the uterus through an arc of 270 degrees. No other observation of malposition of the uterus has been noted, and Couvelaire, in comparing the appearance of the uterus in one of his cases to that of an ovarian cyst with a twisted pedicle, expressly states that the uterus was only rotated to the degree usually found present in pregnancy. While it is true that the pathology observed in pedunculated myomata and in ovarian cysts which have undergone torsion is not dissimilar to that in the uterine wall in the cases under discussion, here again, definite torsion, frequently of an extreme degree, is always present. In veterinary practice a condition of torsion of the pregnant uterus with hæmorrhage and placental separation is observed, but the torsion in these cases is sufficient to obstruct entrance into the uterus through twisting of the vagina or cervix (Rey, Williams). It is interesting to note that this was true in the case of Mazzini. It will thus be seen that in every clinical and experimental case in which a condition analogous to uteroplacental apoplexy has been produced through obstruction to the uterine circulation from torsion, the latter has been definite, of a marked degree, and easily demonstrable. It should be further noted that none of the mechanical hypotheses, with the possible exception of circulatory occlusion, offers a satisfactory explanation of the occurrence of the punctiform hæmorrhages in the tubes, ovaries, and uterine ligaments.

The most important objection which can be urged against the adequacy of any of the mechanical hypotheses, however, is their failure to account for the occurrence of the associated toxæmia. It is true that Morse states he has some experimental evidence to

show that torsion of the pregnant uterus in rabbits produces a toxæmia associated with renal lesions and albuminuria. His experiments along this line are as yet unpublished but it would seem entirely possible that such a torsion, which would probably close the uterus and prevent its emptying itself and at the same time cause fœtal death from placental separation, would, if it did not cause maternal death, rapidly result in a toxæmic state. Young, also, claims that the toxæmia occurring in accidental hæmorrhage is secondary, and not primary, to the placental separation. Briefly stated, his theory is that the toxæmias of pregnancy, including particularly eclampsia, are the result of the absorption into the maternal circulation of toxins derived from autolysis of infarcted areas in the placenta. His views have not received general acceptance and it is difficult to see, if his theory is correct, why toxæmia should not be a constant finding in those cases of placenta prævia in which, instead of one sudden, copious hæmorrhage, smaller hæmorrhages at intervals, spread over a period of weeks or even months, pointing to frequent separations of small areas of placenta. In addition, the clinical evidence adduced in the series of cases under discussion shows very definitely that toxæmic symptoms may precede the actual occurrence of placental separation for a varying period. In one of Smyly's cases this was true for a period of one month.

The toxæmic theory. If, then, we are justified in concluding that uteroplacental apoplexy is not the result of the operation of mechanical causes, except is such exceptional circumstances as those noted in Mazzini's case, the negative evidence that it must be the result of a toxæmic process becomes quite convincing. But the positive evidence is even more so. It has been shown that clinical or pathological evidence of toxæmia is present in approximately 90 per cent of the cases. In 8.7 per cent there has been an associated eclampsia. The degenerative parenchymatous lesions in the liver and kidneys, the hæmorrhages elsewhere in the body, in a word the whole clinical and pathological picture, is definitely toxæmic in character. In accord with this view are found practically all who have studied the subject, among whom may be mentioned Bar, Couvelaire, Essen-Moeller, Williams, Smyly, and Ley.

The nature, method of action, and source of the toxin. If it be granted that the lesions with which we are dealing are the result of the action of a toxin, in the absence of definite knowledge of its toxicology we can draw conclusions as to its nature only from a study of the lesions which it produces. Of these the most striking is hæmorrhage. Williams has compared the pathological picture of uteroplacental apoplexy to that caused by the venom of certain snakes. The comparison is indeed striking. The venom of all the viperine snakes, especially that of the American Crotalinæ, possesses hæmorrhagic properties of a marked degree, as has been shown clinically by Willson and experimentally by Flexner and Noguchi. The elaborate studies of venom made by the latter have demonstrated that these poisons contain protein toxins capable of producing hæmorrhage by a variety of mechanisms, namely: by inhibiting coagulation, by producing thrombosis, and by endotheliolysis. These toxins they have termed hæmorrhagins. The hæmorrhages in the uterine wall and in the adnexa, as has been previously shown, are associated with thrombosis of the smaller veins. The source of the bleeding has not been shown to have been arterial in any case, but solutions in the continuity of the vein walls, communicating with the areas of effusion have been noted, although the capillaries are probably mainly at fault. Such findings point to a process of endotheliolysis. Nor are clinical observations lacking that an inhibition of coagulation may be present. In this series, Snowden's case had oozing from the abdominal incision for several days; Keyworth's case had persistent oozing from superficial abrasions of the vulva and subcutaneous ecchymoses were noted in the cases of Smyly and of Knauer. DeLee has also reported a fatal case of accidental hæmorrhage associated with a hæmorrhagic diathesis; and Harrar has observed subcutaneous ecchymosis in the same condition.

Uteroplacental apoplexy is believed to be, then, a manifestation of the action of a toxin

which possesses properties justifying its being termed a hæmorrhagin. Acting on the tissues of the decidua basalis it produces small areas of hæmorrhage, which, coalescing, determine retroplacental bleeding and consequent placental separation. Acting in the uterine wall it produces lesions of continuity in the veins and capillaries, and also, probably, hæmorrhage by diapedesis. It causes thrombosis of the veins, and a resulting local passive congestion may contribute to the giving way of the vessels. In the decidual, muscular, and peritoneal tissues its toxic action tends to produce necrosis. The explanations of the peritoneal lacerations, which have usually been attributed to the distention of the uterus, is, in all probability, along toxic lines. The weakened and devitalized tissue gives way to the pressure of subperitoneal collections of blood. One of Smyly's cases shows this most strikingly, for, at operation, it was found that the peritoneal covering of the uterus was "in places raised in large blebs filled with blood, one of which on the posterior surface had burst, the rent being about one inch long, and there was free blood in the peritoneal cavity."

It is next necessary to examine the evidence to see if it will justify drawing reliable conclusions as to the source of the toxin. It has usually been held that there was present a general maternal toxæmia, probably closely related to eclampsia. The latter point will be dealt with later. The question here is as to which is the primary lesion, the infarction in the uterus or the general toxæmia. If we accept the hypothesis that the general toxæmia is primary it becomes necessary to assume, it would seem, that we are dealing with a toxin of hæmorrhagic properties with a selective action on the tissues most involved, that is the decidua, myometrium, parametrium, perimetrium, and ovaries. A toxin with such a diversity of biochemical affinities seems unlikely. And yet, with a general toxæmia of the mother as the important etiological factor, how else can the pathological picture be explained? If there is a generally and equally distributed hæmorrhagic toxin present, bleeding should be much more frequently encountered throughout the body, instead of in the uterus and adnexa in such overwhelming degree. It might be suggested that the toxin has an affinity for the tissues of the decidua basalis, produces bleeding there, and that the conditions throughout the uterus are secondary to the placental separation. But such a mechanical explanation has been shown to be untenable.

On the other hand, if we accept the hypothesis, here advanced for the first time, that the source of the toxin is the placenta, the pathological data accurately support this contention. The sequence of events may be briefly sketched as follows: Through the operation of unknown factors, a dysfunction of the placenta becomes established, resulting in the formation and liberation into the blood stream of the mother of a toxin of the nature of a hæmorrhagin. Being absorbed from the placental site, the hæmorrhagic tendency of the toxin would be first and most strongly manifested here. Hence the lesions would be worse in the uterus and its adnexa, and along the path of their lymphatic and venous drainage, namely behind the posterior parietal peritoneum, as in the cases cited. The tendency of the hæmorrhagic extravasation, œdema, necrosis, and peritoneal laceration to be most intense at the placental area is explained. Recalling the rich network of blood and lymphatic vessels just below the peritoneum, the accumulation of the toxin in these accounts for the greater extravasation almost uniformly noted in the superficial layers of the myometrium and under the peritoneum. The general distribution of the toxin throughout the body results in producing renal and hepatic degenerative changes, and occasionally, but not universally, the hæmorrhagic nature of the poison is manifested elsewhere by the occurrence of hæmorrhages in various viscera, ecchymoses in the skin, etc. The hypothesis which I wish to advance may be briefly summed up as follows: There is a hæmorrhagic toxin liberated by the placenta which produces its maximum effect locally, at the site of its innoculation, so to speak, and secondarily produces manifestations of a general toxæmia.

Relation to the other toxæmias of pregnancy. This question, naturally of the greatest im-

portance and interest, is, unfortunately, in the present state of our knowledge, impossible of very definite discussion. The consensus of those who have most studied the subject seems to be to accept a close relationship between uteroplacental apoplexy and eclampsia, and in this series, eclampsia was a complication in 8.7 per cent of the cases. This view of the matter can not be better summed up than by quoting Essen-Moeller, who says, after mentioning the opinion noted above:

"Are there any facts supporting such an opinion? In the first place it must be remembered that the coincidence of eclampsia and accidental hæmorrhage is by no means rare. Many such cases have been published and among my cases I have had 2. Moreover, in cases of eclampsia we not infrequently see bleeding in and on the placenta. . . . To this may be added that bleedings in the inner organs in eclampsia are rather frequent. Liver, spleen, kidneys, brain are often found to be the site of ecchymoses or greater bleedings. Having now learned that bleedings are frequent in the muscle of the uterus, I think we are right in assuming that these bleedings may have the same cause as the others. And last of all, it is striking how often the general state of the patient in a case of accidental hæmorrhage resembles an intensive intoxication, as we see it in eclampsia. . . . But the other reasons I have mentioned speak very much in favor of the supposition that accidental hæmorrhage and eclampsia are genetically connected. The increased blood pressure, which is so common in eclampsia, may also be of some importance for the separation of the placenta. The albuminuria would thus only be a symptom of the general intoxication, which in one case causes eclampsia, in another case accidental hæmorrhage, in a third perhaps both of these diseases. But this does not, of course, give any explanation as to the origin of the accidental hæmorrhage. The problem will then form a part of the great problem of eclampsia or of the toxæmias of pregnancy. But the fact that two groups of symptoms, which we formerly took to be indicative of two different diseases, can be looked upon from a common point of view, seems to be an advantage."

Such are the grounds upon which uteroplacental apoplexy is tentatively related to eclampsia. Should this view of the matter prove to be correct, and should my own contention that the pathological picture points to the placenta as the source of the toxin, receive acceptance, we will have at least some evidence that a placental dysfunctioning is primarily responsible for the occurrence of both conditions. It does not seem entirely improbable that quantitative or qualitative variations in the toxic output of the placenta may well account for quite extreme variations in the resulting clinical picture.

In this connection, however, certain discrepancies must be noted. Thus eclampsia occurs with greater frequency in primiparæ than in multiparæ, where in this series only approximately 25 per cent were primiparæ. Furthermore, eclampsia exhibits no especial tendency to recur in subsequent pregnancies, whereas Couvelaire and others have remarked on the tendency of accidental hæmorrhage to recur, and a history of accidental hæmorrhage or toxæmia in a previous pregnancy was not infrequently noted in the cases in this series. This problem must be left to the future for solution.

RELATION BETWEEN UTEROPLACENTAL APOPLEXY AND ACCIDENTAL HÆMORRHAGE

The question naturally comes up: Are all cases of accidental hæmorrhage toxic in character? While not denying the possibility that traumatism may be an occasional factor in producing placental separation, I believe with Essen-Moeller that such cases are exceptional, and that the toxic cases predominate. In the present state of our knowledge we can only assume, reasoning from analogy with other conditions, that variations in the toxic qualities and amount of the toxin, and the duration of its excretion, may determine wide clinical and pathological differences. The presence of albuminuria in a large proportion of the cases of accidental hæmorrhage is significant. The rapidity with which the cases under discussion have been accumulating in the literature recently would seem to justify the conclusion that similar lesions, of a milder type, are undoubtedly present in many cases of accidental hæmorrhage which do not come to laparotomy or autopsy. Ahlström considers this point, and says: "I have collected, in addition to my 3 cases, 23 cases published since Couvelaire's paper in 1911, showing hæmorrhagic infiltration of the uterus, while at the same time I have found 15 cases in which the description was sufficiently clear, even when the point was not definitely mentioned, to justify the conclusion that no

infiltration was present." It is entirely possible to believe, however, that a careful microscopical examination of such uteri would demonstrate slight hæmorrhagic lesions in the decidua basalis or uterine wall. My own belief is that practically all cases of premature separation of the normally implanted placenta will ultimately prove to be caused by the same placental poisoning which in extreme cases produces the typical picture of fulminating uteroplacental apoplexy.

CLINICAL CONSIDERATIONS

As this paper is not concerned with the general subject of accidental hæmorrhage, it is necessary to take up here only the points on the clinical side on which light may have been thrown by the study of uteroplacental apoplexy.

Symptoms. With the exception of showing the symptoms of toxæmia to a more marked degree, the cases in this series have presented only the usual symptoms of accidental hæmorrhage, namely: sudden onset of constant abdominal pain, shock, external bleeding, ligneous consistency of the uterus, and acute anæmia. The occurrence of postpartum hæmorrhage in so many cases is very significant, indicating the disorganized state of the uterine wall and its inability to control hæmorrhage by the normal mechanism of retraction and contraction.

Diagnosis. The diagnosis of uteroplacental apoplexy can be definitely made only by direct inspection. It should be suspected in all the more serious cases of accidental hæmorrhage, and marked evidence of toxæmia, or severe postpartum hæmorrhage point strongly to its presence.

Prognosis. This is uniformly grave. The maternal mortality was 38 per cent in 50 cases diagnosed during life. The fœtal mortality was 92.5 per cent in 67 cases.

Treatment. Many practical applications of the various clinical and pathological data discussed above will immediately suggest themselves in connection with the subject of treatment. In the first place it must be borne in mind that all cases of accidental hæmorrhage are not necessarily critical. In some cases the bleeding is slight, the uterus gives little or no evidence of filling with blood or of interference with its function, and the constitutional symptoms are slight or entirely lacking. Here it is, of course, unwise to be stampeded into an unnecessary radicalism. Such cases are best left to the unaided efforts of nature. In the severe cases, especially where the evidence of toxæmia points to the serious involvement of the uterine wall, the situation is most critical, and an intelligent radicalism will probably in most cases prove to be most conservative. In such cases the points to be borne in mind are the damaged state of the uterine wall and the possibility of intra-abdominal and postpartum bleeding. When the condition of the cervix permits immediate vaginal delivery, this should be accomplished as promptly and conservatively as possible. In the management of the third stage the nicest judgment will be necessary. The first evidence of postpartum hæmorrhage should indicate the most thorough and immediate packing of the uterus. The occurrence of bleeding through the packing, or a progressive deterioration of the patient's general condition should be met by immediate abdominal hysterectomy.

In the severe cases occurring before or early in labor there can be no question that immediate operative intervention is urgently indicated. I have no hesitancy in saying that the abdominal route should always be selected and that vaginal hysterotomy has no legitimate place in meeting such a situation. The abdominal operation gives immediate control of the sources of the hæmorrhage and effects a non-traumatizing delivery at the same time. With the abdomen open and confronted by a typical case of uteroplacental apoplexy what course should be followed? Couvelaire held that a marked hæmorrhagic infiltration of the uterus always indicated a Porro operation. This contention has not been generally endorsed. The first step should look toward conservative cæsarean section. Every effort should then be made to make the uterus contract and if this can be satisfactorily accomplished it should be allowed to remain. It would seem reasonable to believe that the normal involutionary processes would cause rapid absorption of the hæmorrhagic effusion

and return the organ to a condition not incompatible with the performance of its functions in a subsequent pregnancy. If, on the other hand, a seriously damaged organ fails to control bleeding too much time should not be lost in the effort to make it do so, and it should be amputated supravaginally. Such a procedure might be properly undertaken on slighter indications in multiparæ than in primiparæ. The statistics of this series of cases, previously given, show that conservative cæsarean section offers the greatest hope for recovery. After giving due consideration to the fact that Porro operations were probably done in the worst cases, my impression is that the better results noted in the conservative operations were not entirely due to this cause.

CONCLUSIONS

My conclusions as a result of this study are as follows:

1. Uteroplacental apoplexy is caused by the inundation of the uterine wall with a toxin of the nature of a hæmorrhagin, liberated from the placenta, and, naturally, producing its maximum effect at the site of its absorption and greatest concentration.

2. Accidental hæmorrhage is probably, in the great majority of cases, a manifestation of the same process.

3. Clinically, the significant fact in the pathology is the damaged state of the uterine wall, which tends to cause both intra-abdominal and postpartum hæmorrhage.

4. In severe cases, with an undilated cervix, the most conservative treatment is abdominal cæsarean section, followed by hysterectomy, if indicated, in order to assure certain hemostasis.

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DEPARTMENT OF TECHNIQUE

SOME OBSERVATIONS UPON THE TREATMENT OF HIP-JOINT DISEASE

By JOHN E. FISH, M.D., Canton, Massachusetts
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THE establishment of a principle which invariably holds true in the treatment of disease is a difficult, if not impossible, attainment; but the exceptional opportunity for the study of hip-joint disease afforded at the Massachusetts Hospital School may serve to bind together some scattered facts for contemplation and lead to a more uniform and rational treatment of this affection.

The Massachusetts Hospital School is a public charitable institution for the care and education of the crippled and deformed children of the State and while it is maintained primarily as a school, it has hospital facilities and a resident medical staff. Covering the period of 13 years since the institution was established, nearly one thousand patients have been under treatment and of this number approximately one hundred and seventy-five children were suffering from hip-joint disease. In the vast majority of these cases, there was apparently no question as to diagnosis at the various hospitals in which previous treatment had been prescribed. In fact the symptoms have been exceedingly conspicuous in practically all the patients received at the State school. Extensive abscess formation has been by no means uncommon and many cases without open sinuses have been found to be rapidly advancing toward suppuration.

That there either had been doubt or uncertainty as to treatment or a wide range of opinion respecting the management of hip disease at various hospitals throughout the State was evident from the histories obtained and from the treatment previously advised. Children with some very acute hip conditions, with marked flexion and adduction deformity, have come in with only a pair of crutches as a means of obtaining relief, and others had been treated by the local application of liniments and physiological rest in bed. While a very few cases were admitted soon after the earliest appearance of symptoms and others had been given careful and consistent treatment by effective traction and immobilization, by far the largest number had been treated with plaster-of-Paris bandages applied in a variety of forms.

It has always been the policy of the institution to procure in all cases the fullest possible previous history obtainable from hospitals and surgeons by whom patients have been treated and, whenever practicable, to continue the treatment which had been prescribed. At first the previous treatment was followed for a few weeks at least, provided the patients had been recently under what was thought to be appropriate treatment; but it very soon became apparent that complete physical examinations upon entrance and the progress of the cases could not in this way be followed with the thoroughness which was essential in a State institution. Furthermore, when the removal of plaster-of-Paris bandages was delayed, it was often embarrassing to the administration to attempt to explain to the satisfaction of children's parents how and when abscesses had formed and atrophy and plaster sloughs occurred in parts which had appeared to them quite normal when last seen. For the above reasons rather than because of any prejudice for or against any particular method of treatment, it soon became the universal practice to remove every form of mechanical apparatus immediately upon the child's entrance to the school infirmary. Thorough physical examinations including X-rays were then made and the patients were put to bed under traction by means of weights and pulleys until the cases were reviewed by the staff or some member of the board of orthopedic consultants and the treatment to be followed agreed upon.

A few of the photographs taken upon admission will not only serve to illustrate some of the problems with which the Hospital School was confronted, but also show the woeful lack of uniformity with which cases of hip disease have been managed.

Figure 1 is that of a (6-year-old) boy upon admission 5 years after the onset of hip disease, for which no mechanical appliance had ever been prescribed. While nature's cure had resulted in some very unfortunate deformities and complete ankylosis of the joint, the next patient (Figures 2 and 3) was found to have deformities to an equally distressing degree after suffering for 3 years with the added burden of a series of plaster-of-Paris casts. The hip was still sensitive, the femoral head had been destroyed and the destructive process was still going on at a rapid pace. The conclusion may be drawn that the plaster bandages were not properly applied or that successive casts were not made by the same surgeons at out-patient clinics and that the treatment had not been consistently followed.

The patient shown in Figure 4 had been under plaster treatment for about 11 months and the last cast as shown in the picture had been applied just before admission. That the attempt at immobilization was not effective is shown by the space between the thigh and the plaster. Pain and adductor spasm were also prominent features.

The extent to which the soft tissues sometimes become involved may be seen in another case (Figures 5 and 6). This patient had been treated with successive plaster spicas for about 18 months. He was in extremely bad health and died shortly after admission. These few cases have been cited and many more could be added to prove why the plaster spica is not regarded with special favor at the Massachusetts Hospital School in which many terminal cases of hip-joint disease are received.

Some years ago the writer had occasion to consult Dr. Edward H. Bradford concerning the management of a very troublesome case of hip disease in a rapidly growing adolescent girl who had been sent to the State school as a last resort. A heavy, burdensome plaster spica was removed and the child relieved of a great deal of pain and made fairly comfortable in bed with the regulation weights and pulley traction. The consultant complimented the staff upon the skill with which the hip was being managed, position was good and the weights adequate; but he significantly remarked: "While the hip suggested that the child should be in bed, her face indicated that she should be up." Prolonged plaster treatment having failed, it was finally decided to employ the traction abduction splint which was designed by Dr. Bradford some years ago for use at the Boston Children's Hospital. The child's hip had been extremely painful for a long time, the prolonged suffering being expressed by her features in the clearest manner. The relief afforded by the bed traction was also given by the traction splint which, at the same time, did away with the necessity of greatly restricting the child's freedom. Her appetite improved from the first, she attended a short daily session of school and improvement to an eventual recovery was most gratifying. The merits of the Bradford abduction splint were sufficiently obvious in this case to justify its use in other cases until it gradually came to be regarded as indispensable to the welfare of many cases of hip disease seen at the Hospital School.

Contrary to the opinions of some to whom the advantages of the splint have been demonstrated, it is neither difficult to make and apply nor troublesome to keep effectively in place. How well the splint (Figure 7) is adapted by the abduction arm to hold the thigh in a position to be desired and to permit as much pull by means of the ratchet as may be necessary to overcome muscle spasm, is illustrated by Figure 8.

On February 3, 1914, a (9-year-old) boy was admitted to the school infirmary by transfer from one of the larger general hospitals in which a heavy plaster cast had been applied to his left hip-joint 3 months previously. In September, 1913, he had fallen from a fence; but no direct injury was suspected until 2 months later when he complained of pain and began to walk with a limp. He was taken to the hospital in November, the symptoms meantime gradually getting worse. A diagnosis of tuberculous disease of the joint was made, the regulation plaster cast put on, and he was kept under continuous observation as a house patient until he was discharged to the Massachusetts Hospital School. Upon removal of the plaster spica the superficial veins were observed to be much enlarged and, while there was no localized fluctuation, there was marked swelling about the thigh which extended into the foot. The hip was very painful with marked muscular spasm and the characteristic symptoms of moderate flexion and adduction deformity, but no apparent shortening. A positive von Pirquet test was obtained and a deep abscess formation shortly came to the surface in three discharging sinuses. The X-ray in this case showed roughening of the upper margin of the acetabulum and lower half of the surface of the femoral head.

This was thought to be a case in which the plaster spica should not be reapplied, neither did it seem advisable to keep the child long in bed and a Bradford abduction splint was accordingly

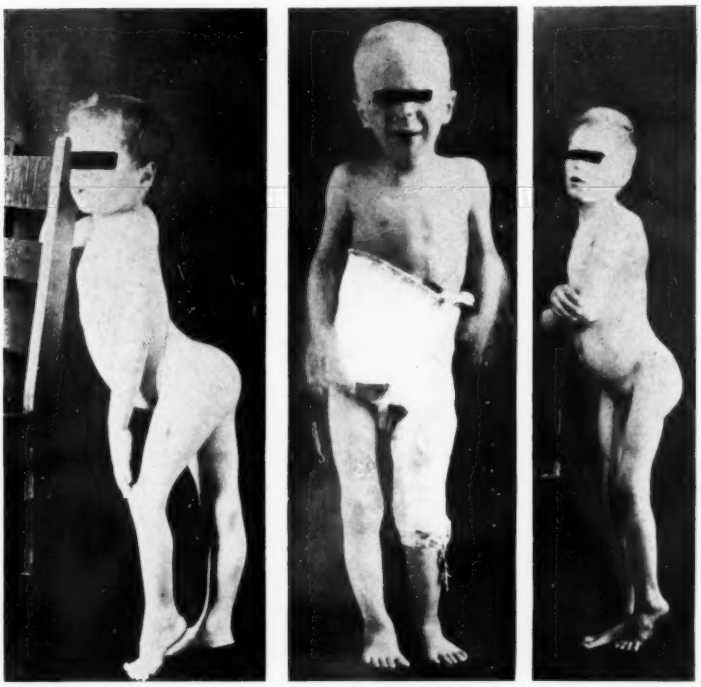


Fig. 1. Fig. 2. Fig. 3.

Fig. 1. Six-year-old boy upon admission to hospital, 5 years after onset of hip disease. No mechanical appliances had been applied.

Figs. 2 and 3. Patient 3 years after onset of disease. Treated with a series of plaster-of-Paris casts.

Fig. 4. Patient had been under plaster treatment 11 months. Note space between thigh and cast.

made and worn for a period of about 2 years, as shown in Figure 9. Improvement was rapid, there was a steady gain in weight, the sinuses healed promptly, and with the aid of crutches and a high sole to enable the boy to swing the splint clear of the floor, he was able to get about and attend an open-air school. When the newly-formed hard tissues were thought to be firm enough to permit moderate weight-bearing, the traction straps were removed and the splint worn as a perineal crutch. In June, 1917, when the splint was removed altogether, an examination showed apparent recovery without shortening and with good motion in all directions. The boy continued to remain at the school for a few months until much of the atrophy which had taken place had been overcome and he was finally discharged in March, 1918, 4 years from the date of entrance. In order that there might be no doubt as to the permanency of the recovery, he was examined 2

Figs. 5 and 6. Showing extent to which soft tissue sometimes become involved. Patient treated with successive plaster casts for about 18 months.

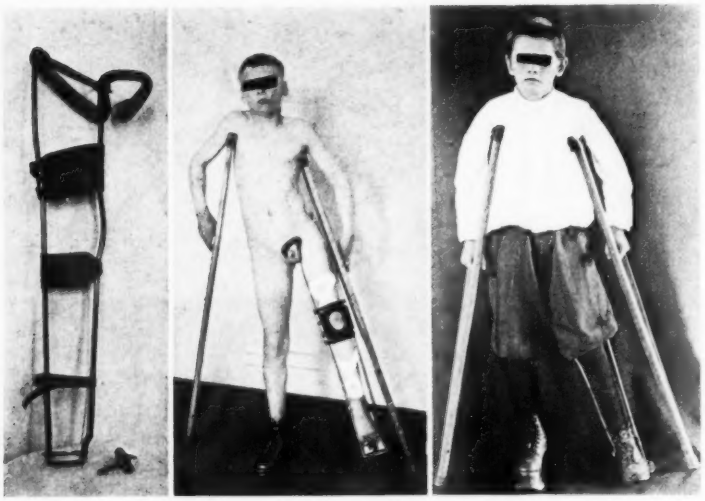
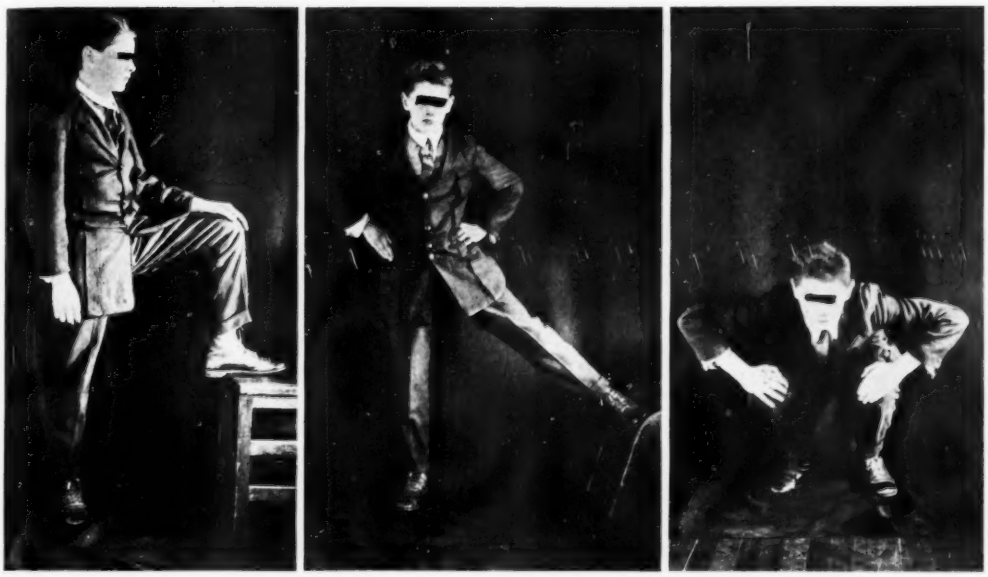


Fig. 7. Fig. 8. Fig. 9.

Fig. 7. Bradford traction abduction splint.
Fig. 8. Bradford splint applied showing how well it is adapted by abduction arm to hold the thigh in position desired and to permit as much pull by means of the ratchet as may be necessary to overcome muscle spasm.
Fig. 9. Another case in which the Bradford splint was applied and worn for a period of 2 years.

years later and the photographs (Figures 10, 11, and 12) taken for the completion of his case record.

Occasionally cases have been sent to the Hospital School very soon after the first appearance of hip disease and have been treated with the abduction splint from the first. Practically without exception these cases, as well as those few for whom the splint had been early prescribed elsewhere and who afterward came to the State



Figs. 10, 11, and 12. Photographs of patient shown in Figure 9, taken 2 years after discharged as cured.

school to have the same treatment continued, have made good recoveries with motion, which has not been found to be true in the much larger number of cases for whom plaster treatment had been long prescribed.

The question has sometimes been raised as to whether patients in whom almost perfect recovery had taken place were not suffering from some other affection than that of a tuberculous invasion of the joint. While it is doubtless true that some recovered cases were not tuberculous, there appears to be no doubt but that many of them were, and after all pathological refinements in diagnosis are not essential to the treatment of an acute destructive disease process in the bones of the hip-joint.

All the cases taken together and considered as a series or group, seem strongly to suggest that there is an opportunity for improvement in the management of the average run of cases of hip-joint disease. They certainly have given some important evidence of the value of the Bradford abduction hip splint and so favorably has it been regarded by those who have had an opportunity to become familiar with its use in caries of the hip-joint, that it has even been employed with marked success in the treatment of fractures of the neck of the femur.

THE CLINICAL ASPECT OF TENDON TRANSPOSITION

By M. A. BERNSTEIN, M.D., Chicago

IN former publications[1] I have described a method of tendon transposition which was based upon animal experiments and upon a technique developed on cadavers. The method, in brief, consists in transposing a healthy tendon together with its sheath and peritendinous structures,[2] to replace a paralyzed one. In the lower portion of the peroneus longus muscle, a plastic is performed on the sheath to enclose the tendon at that point (Fig. 5). This paper deals with the clinical application of these principles, and a report of cases operated upon.

From studies of embryological specimens and anatomical dissections it is found that the tendon with its peritendinous structures comprises an integral unit. While the sheath is looked upon as a fluid buffer to protect the tendon from external violence and also as a medium through which the tendon can glide more easily, it serves a greater purpose surgically. It protects the tendon from traumatism in tendon transposition; it permits the peritendinous structures to bear the effects of accidents from infection; it preserves the blood supply and prevents the formation of adhesions directly to the tendon.

Embryologically there is an early differentiation of tendon and tendon synovia. Long before there is function in the tendon, the sheath is seen in the process of formation. This disproves the theory of Velpeau that function is necessary for its formation. Motion helps to develop, not to form, tendon synovia. While it is impossible to state that tendon synovia exists morphologically in the embryo of 2½ months, there is a definite development which indicates that the tendon sheath is in a stage of formation. The tendon synovial development begins as a rarefaction of the embryonal tissue about the tendon. When this is complete the cavity is formed. Lowell and Tanner state: "Histologically the tendon is originally embedded in a homogeneous tissue in which the fibrous canals are seen as dense tracts. The embedding tissue takes on a mucous character and gives place to the first synovia." My deductions are as follows: The tendon, or rather what will eventually become tendon tissue, is seen as a thin, homogeneous ring. This ring or half ring has no definite relation to the tendon, and is irregular in outline (Fig. 1). However, it can be seen that this ring consists of two layers, an inner and an outer, and corresponds to the parietal and visceral layers of the fully developed tendon sheath. The tendon sheath soon approximates itself and surrounds the tendon on all of its sides. Cleavage takes place in both layers on the mesial side of the tendon, with the formation of mesotendons (Fig. 2). When a fully developed tendon is lifted out of its sheath it is found attached to the floor of the sheath by means of these mesi. Above the level of the sheath a special arrangement can be seen. Lowell and Tanner say that at the muscular tendinous junction there appears a reflection of a specialized portion of the perimesium. This is composed of areolar connective tissue and is attached to the tendon and the sheath and becomes continuous with the peritendineum externum. A fold is formed which allows for contraction and relaxation of the tendon. This fold or reflection prevents rupture of the sheath at that point during the phase of contraction. It is claimed that the gliding of the tendon is dependent upon this special arrangement. This structure must, therefore, be preserved when the tendon is transposed.

I shall not go into further detail of tendon anatomy since it can be found described in articles by Biesalski and Mayer, Lowell and Tanner, Steindler, and others. Suffice it to say that a clear conception of the anatomical relations, and of the physiological functions of these structures is necessary, if a functional result is to be expected from tendon transposition.

The older methods of tendon transposition, namely the anatomical transpositions of Nicoladini, and the direct implantation method of Lange and Drobnik and their various imitators, did not take into account the physiological relations of the tendon to its peritendinous structures. These methods emphasized the position of the transposed tendon, its exact mode of implantation or insertion, and the technical details of suture. Little or no attention was given to the tendon itself or to the conditions which influence its function. The effects of surgical trauma were ignored. The fundamental physiological conditions upon which the gliding and nutriment of a tendon depend did not receive proper recognition in practical surgery. The value of physiolog-

[1] Surg. Clin. Chicago, 1918, Oct.; Surg., Gynec. & Obst., 1920, xxix, 55.

[2] Peritendinous structures comprise the sheath, mesotendon, paratenon, and all the structures which surround the tendon.

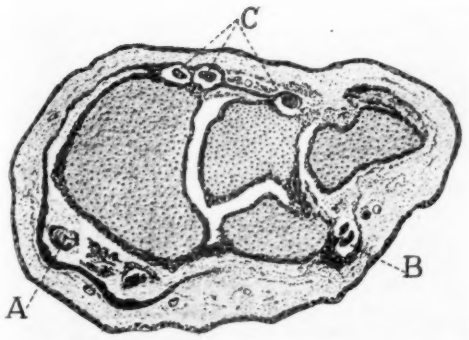


Fig. 1. Cross section of ankle of fœtus 3 months old. *a*, Flexor group of muscles; *b*, peroneus group; *c*, anterior tibial group. Note the development of the sheath at *b*. There is as yet no differentiation of sheath from the surrounding tissue, but there is evidence of its formation from the cell grouping.

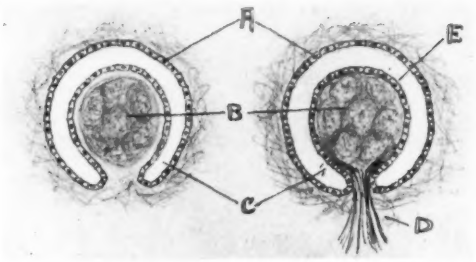


Fig. 2. Schematic illustration of the development of the tendon sheath. *a*, Outer sheath wall; *b*, tendon; *c*, cavity of the sheath; *d*, mesotenon; *e*, peritendonium externum (epitenon).

ical transposition has, however, been recently recognized. Biesalski and Mayer have clearly seen its importance, although in their technique some of the anatomical peritendinous structures are destroyed. Mayer's method consists in removing the tendon from its surroundings and from the tendon sheath, and transposing it through the sheath of the paralyzed tendon. His criticism of my method is that it is limited in its application, and that it is impossible to transpose the peroneus longus with its sheath, because the sheath does not completely surround the tendon at the external malleolus, so that a considerable portion of the tendon is deprived of tendon sheath. The criticisms advanced by him are not well founded, because I have transposed the principal tendons without difficulty, and as for the peroneus longus transposition it can be seen that the sheath is transposed without great difficulty.

Steindler fully recognizes the necessity for a biological transposition and while avowedly following the method of Biesalski and Mayer, insists upon the necessity of supplementing it by the preservation of the mesotenon in order to insure the vitality of the transposed tendon and prevent its fibrosis. He states that when he reoperated upon a case for which a tendon transposition was done by the old method of tendon stripping he found "that while they (the tendons) had not torn loose from their attachment they had degenerated into fine and insignificant bundles of a few fibers stretching out and utterly incapable of producing any mechanical action." It would be interesting to know what his findings would be in the cases operated upon by his modification. I had occasion to re-operate upon two of my cases, one because the tendon was too long and exercised no movement of the joint although it could be seen to contract; the other because the tendon became loosened from its attachment as a result of liquefaction necrosis and became attached to the subcutaneous tissue. The tendons were easily isolated from the surrounding tissue and appeared normal. A section of tendon was removed for microscopic study and showed no change whatever.

Bunnell also recognizes the necessity of preserving and removing the tendon with the intact peritendinous structures. He has done complete tendon transplantations in the hand. Unfortunately, the end-results of complete tendon transplantation, especially in the hands and fingers, are not as satisfactory as we hope to see accomplished in the future.

The methods of practical tendon transposition followed up to the present time have not accomplished the satisfactory results which were claimed for them. While these procedures could be relied upon as practicable, yet the functional results were generally poor, and a surgeon could not be assured that after the most careful technique and operative care the functional end for which the operation was performed, would be effected. The whole *raison d'être* of the operation, namely, the substitution of a functioning tendon for a paralyzed one, generally failed in practice.

The reasons why tendon transposition failed were that the tendon became fibrous; adhesions formed between the tendon and the tissue surrounding it in its new position; that bony structural changes in the joints were not corrected, and that poor tendons were used to replace paralyzed ones. The histological findings in specimens removed when a tendon was trans-

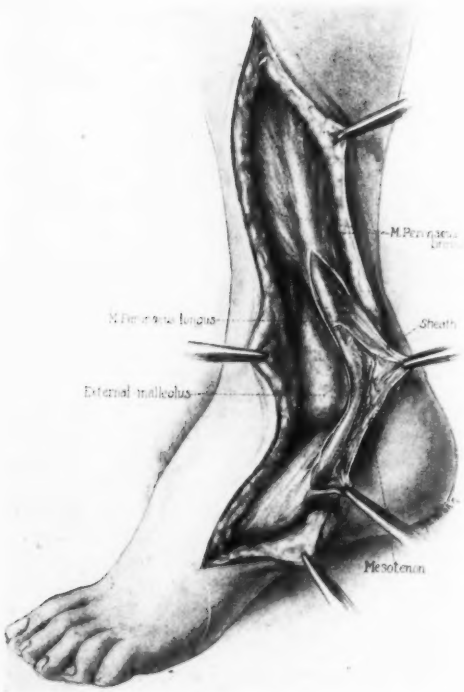


Fig. 3. Incision for transposition of the peroneus longus muscle.

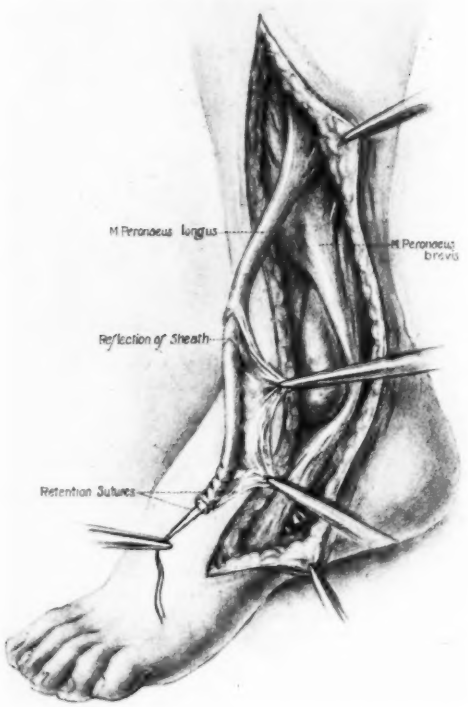


Fig. 4. Peroneus longus tendon dissected out with its sheath. Fixation sutures in place. Notice the amount of free sheath flap carried over with the tendon.

posed by the older methods, show that the proliferative and infiltrative changes seriously interfere with function. Even when the tendon is transposed through the sheath of another tendon, there follows a traumatic inflammatory reaction with organization of the exudate. This exudate resembles that of a tenovaginitis, and adhesions are likely to follow as a result of insufficient absorption. It is, therefore, clearly evident that when a tendon is transposed together with the sheath and peritendinous structures, there is no reaction between the tendon and the sheath and no opportunity for adhesions to form directly to the tendon. When adhesions do form they are to the peritendinous structures and do not interfere with the gliding mechanism. Since the blood supply is not materially interfered with by preservation of the mesotenon, there is no atrophy or fibrosis of the tendon. The histological results fully justify the transposition of a tendon together with its sheath and therefore this operation may be considered a true physiological method of tendon transposition.

Whatever method is employed there are certain practical points to be considered: The tendons to be transposed must be strong enough to perform the work imposed upon them. A muscle that has been involved in the acute stage of poliomyelitis and has not fully recovered its strength is not fit for transposition. The use of such material is one of the most frequent causes for failure. It is not to be expected that a muscle which functioned poorly in its original position will work better when transposed, when it may have to assume still greater obligations.

The proper length of a muscle must be provided to give optimum conditions for contraction. Often a transposed muscle is seen to contract, and yet it produces no movement of the joint. This is usually due to too much play. It takes very little slack in a muscle to produce interference with function. I should prefer to suture a

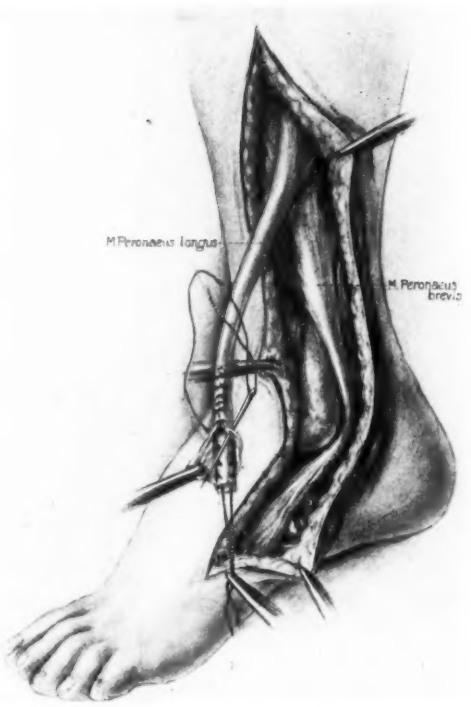


Fig. 5. Method of closing the sheath. The suture material used is fine catgut.

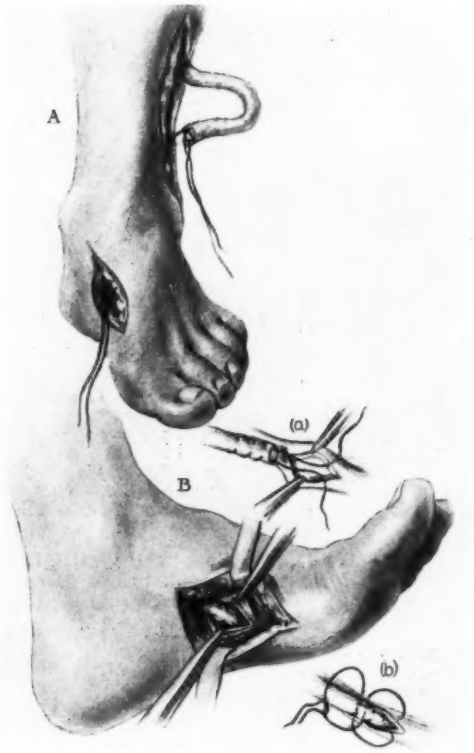
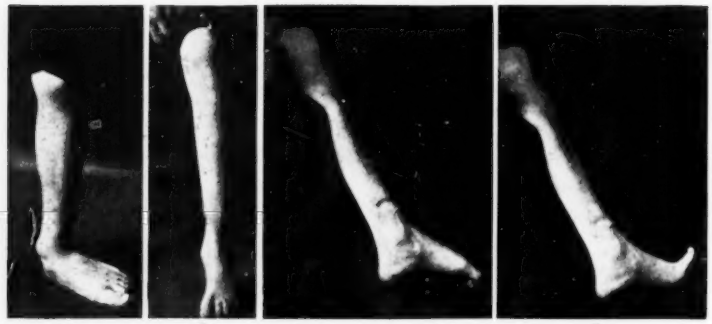


Fig. 6. *A*, The peroneus longus tendon is ready to be drawn to the inner side of the foot to the insertion of the tibialis anticus muscle insertion. *a*, Shows the method of splitting the tibialis anticus tendon at its insertion to receive the transposed tendon. The suture goes through the tendon and periosteum of the first cuneiform bone. *B*, Shows the transposed tendon in place. The forceps are upon the retracted tibialis anticus tendon.

tendon under a little tension rather than to leave it too long. A taut muscle can be relieved by overcorrecting the joint.

We often pronounce muscles permanently paralyzed and subject the patient indefinitely to the wearing of braces or of casts, and the result is muscle inactivity, arrest of active circulation, and consequently a thin, shrunken extremity. One must always bear in mind that there is a limit to conservative treatment and plan operative procedures for ultimate correction. When a tendon transposition has been done and the result is a failure, it is because the surgeon has used bad judgment in selecting his case. Merely because an extremity is disabled as a result of poliomyelitis is no indication that tendon transposition will be of benefit. One must study the individual case to determine which muscles are paralyzed and which ones have been spared. The operation of tendon transposition should not be made to fit the case but the case selected to fit the operation. Often an apparently paralyzed muscle can be made to function when a healthy muscle is joined adjacent to its point of insertion. To illustrate, the tibialis anticus muscle may have lost its function, but the extensor proprius muscle is active, and when transposed to the insertion of the tibialis anticus, the latter is stimulated to contractility due to the contraction of the former. This phenomenon can be explained in this manner: first, the relaxed and stretched tibialis anticus is given an opportunity to contract, this being accomplished by taking up the slack of relaxation, as pointed out by Sir Robert Jones; and second, the muscle is permitted to take part in the contraction of the transposed muscle, and is thereby re-educated to contractility. This phase corresponds to the muscle training of Robert Lovett, but in this



a *b* *c* *d*

Fig. 7. *a*, Paralysis of the anterior tibial muscle and to some extent of the extensor proprius hallucis. Taken before operation. There was inability to dorsiflex and abduct the foot.

b, Position of the foot 2 years after operation. The peroneus longus was transposed together with the peritendinous structures to replace the tibialis anticus. Notice the stability of the foot and the amount of abduction.

c, Showing the amount of plantar flexion.

d, Showing the amount of dorsiflexion of the foot.

instance the transposed muscle trains the paralyzed one.

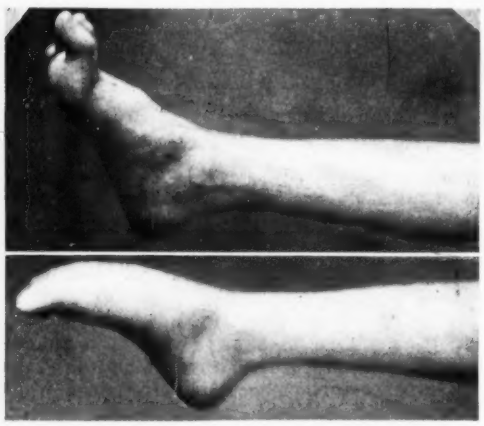


Fig. 8. No picture was taken of this foot before operation. There was a paralysis of the tibialis anticus but the extensor of the large toe was in good condition. The patient walked with a valgus deformity and was unable to abduct the foot. The extensor longus hallucis was transposed to the insertion of the tibialis anticus. Notice the amount of dorsiflexion of the foot. Note also that the extensor function to the great toe is not destroyed. This was accomplished by suturing the cut stump of the extensor proprius hallucis to the common extensors of the toes. This photograph was taken 2 years after operation.

The lower picture shows the amount of plantar flexion.

CASE 1. This patient was 9 years of age when I first saw him (Fig. 3). He had a typical attack of acute poliomyelitis when he was 3 years of age. Treatment as carried out by a practitioner consisted of electrical stimulation, massage, etc. The ultimate result was a paralysis of his anterior leg muscles, namely, tibialis anticus, extensor proprius hallucis, and to some extent the extensor communis digitorum. He wore a brace to correct the resulting valgus deformity, but the correction was not accomplished. I removed the brace, and for many months thereafter treated each muscle with mild applications of the faradic and galvanic current and muscle training. There was no response from the stimulation and the muscles regained no strength. He was operated upon at Michael Reese Hospital 3 years ago. The peroneus longus was transposed together with its sheath and inserted into the split tibialis anticus at its point of insertion subperiosteally into the base of the first metatarsal bone. The technique employed may be described as follows:

Operation. An incision is made beginning at the upper outer third of the leg over the course of the peroneus longus muscle and extending downward, curving around and beneath the external malleolus to about the peroneal tubercle on the outer side of the foot (Fig. 3). The knife is changed, and the skin edges are protected. The peroneus longus is exposed, and the deep fascia carefully dissected away. The tendon of the peroneus longus is isolated at the lower end of the incision where it passes to the plantar surface of the foot, and is severed. Retention sutures are introduced, and the tendon is gently

Fig. 9. *a* (at left), Paralysis of peronei muscles. Patient had poliomyelitis when a child, is now 20. She is unable to abduct the foot.

b, Three years after operation. The extensor proprius hallucis was transposed to the outer side of the foot to the insertion of the peroneus tertius. Notice wrinkling of skin over the contracted tendon.

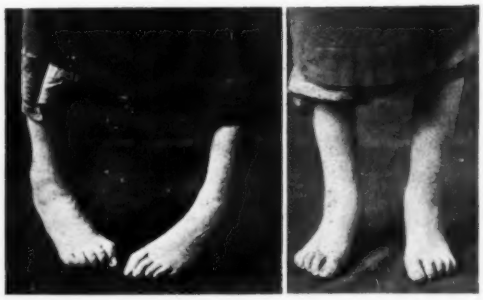


Fig. 10. *a* (at left), This photograph is a pose endeavoring to simulate the position of the feet before operation. The patient had poliomyelitis when 10 years of age. She is now 26. She wore braces on both legs and used crutches, walking with great difficulty. In her case the peronei were paralyzed and there was very little power in the anterior muscles from contraction.

b, The tendo achillis was split and detached from the outer surface of its attachment following somewhat the original Nicoladini operation and sutured to the peroneus longus, after the method of Vulpius. Operation performed in April, 1913.

lifted out of its bed. The suture material used for the fixation is kangaroo tendon. The method of inserting the suture must be such as not to constrict the tendon bundles. I have, therefore, employed a method which I call the "herring-bone stitch" (Fig. 6, *b*). (I have found that by using silk a considerable amount of constriction is produced which causes pressure necrosis with liquefaction of the tendon at the point of insertion. This is discovered about the tenth day after the operation and is shown by the discharge of a serous exudate which resembles infectious material. It is needless to say that the occurrence of such an accident is detrimental to the entire operative procedure, since the tendon is entirely loosened from its periosteal moorings and assumes a subcutaneous fixation.) The tendon is now removed from its surrounding tissue by means of a scissors, taking with it as much of the peritendinous structures as possible. When the external malleolus is reached it is found that the peroneus longus and brevis occupy the same synovial compartment, and that the two are intimately connected for about an inch and a quarter. The roof of the canal is now cut. This corresponds to the lateral ligament of the ankle-joint and fascia cruris and, therefore, must be respected. The tendon is delivered from this canal and is found attached to the floor by means of the mesotendon which at this point is about 6 centimeters in length. This is cut as low down and as far away from the tendon as possible, and releases the tendon to the point where it is surrounded by its own sheath (Fig. 4). The tendon with its sheath is isolated to beyond the musculotendinous junction. This is done to assure direct muscular pull. A plastic is performed upon the lower portion of the sheath (Fig. 5). This is done in the following manner (I wish to call special attention to this part of the operation since I have received numerous inquiries to clarify this step):

Two Allis forceps are placed upon the free flap and the flap stretched out. Great care must be exercised in doing this since this part of the sheath is veil-like and tears very easily. The flap is brought over so that it surrounds the tendon and is sewed by means of fine catgut threaded in a cambric needle (Fig. 5). The sheath now surrounds the tendon on all of its sides, leaving only a small portion of the tendon exposed at the point for insertion.

A tunnel is made by passing a large veterinary eye probe downward and inward along the course of the tibialis anticus muscle, forcing it down to the point of insertion of that tendon. A curved incision is made over the tip of the probe which corresponds to the insertion of the tibialis anti-

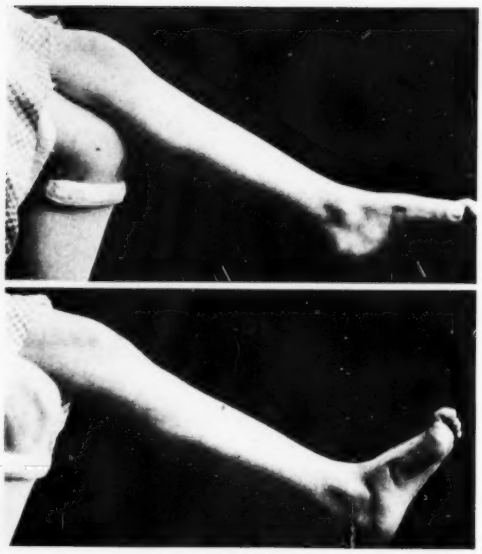


Fig. 11. *a* (above), Girl, age 21, had poliomyelitis when a child. This resulted in a paralysis of the anterior tibial and the extensor muscles of the thigh. Function returned in the extensors of the thigh as seen by the ability of the patient to extend her leg. The extensor longus hallucis muscle was spastic so that the large toe was overextended and rubbed on the under surface of the shoe. A physician amputated the large toe to relieve the contraction. Fortunately, the first phalanx only was removed. The operation performed in this case, May, 1920, consisted of transposing the extensor longus hallucis to the insertion of the paralyzed tibialis anticus. Point of insertion can be seen inside of foot. The proximal phalanx of the large toe was brought down and a fascial flap inserted between the articulation, the distal portion of the extensor longus hallucis was sutured to the common extensor so that patient now has a fairly useful large toe. An arthrodesis was performed between the calcaneoschaphoid bones, to give the foot more stability.

cus muscle, and the tip of the probe is delivered. The two ends of the probe are seized and moved from side to side so that the width of the canal is increased. It is necessary to incise the fascial planes at the point of entrance of the transposed tendon so that the tendon will not become strangulated (Fig. 6, *A*). The probe is threaded by means of the kangaroo fixation suture and is pulled down. The tendon is steadied and prevented from twisting, and brought out at the lower point of the incision.

The tendon does not pass superficially beneath the skin, but is found to pass beneath the annular ligament. The tendon is fixed to its new position as (Fig. 6, *B*). It is advisable not to constrict the tendon at this point by placing too many fixation sutures because of pressure necrosis. The skin is closed with catgut and a circular cast applied, extending from above the knee and including the toes. Returning now to the long posterior incision, the cut lateral ligament is sutured by a continuous fine kangaroo tendon. Care must be taken to suture the structures around the external malleolus very carefully so that the integrity of the joint is not destroyed. The cast is retained for 6 weeks, when it is entirely removed and active and passive motion carried out for 10 days, when walking is permitted. At the end of this time there is a physiological fixation of the tendon to its new point of insertion, and one is perfectly safe in permitting the use of the foot.

In every case of poliomyelitis there is some shortening of the extremity, and it is necessary to have a properly fitted shoe with an insole padded to compensate for the loss in length of the leg.

CONCLUSIONS

Tendon transplantation has a definite indication in the operative treatment of anterior poliomyelitis. If the results obtained are not satisfactory, the indications in a broad sense were not well defined.

Tendons should be transposed from the same plane when possible. When transposed from an opposite group, muscle training must be carried out, over longer periods.

Tendons must be transposed with their sheath and peritenous structures so that the vitality of the tendon is not interfered with.

When a tendon is transposed with its sheath adhesions are not likely to occur.

The operation must be carried out with care, avoiding trauma, exposure of the tendon to the air, and with as little handling as possible.

A MAMMOTH OVARIAN TUMOR

By JAMES W. WARD, M.D., San Francisco

MRS. J. F., age 47, first came under my observation in 1890, when I was called to attend her during an attack of peritonitis, which appeared in some way to be related to an ovarian cyst of moderate size. The patient's symptoms were abdominal pain and tenderness, vomiting, fever, and abdominal distention.

From this attack, she made a prompt recovery, and was not again ill with a similar condition until 1893. The abdominal distention had then increased, although she stated that she had enjoyed splendid health during the interval. Because of the history, I advised surgical interference, which, however, was emphatically declined.

I was not called again until the summer of 1907, some 14 years later, when I found her in a most deplorable condition. The tumor had attained tremendous size, and now caused almost constant pain and suffering. She had been confined for some time to her bed, although until fall she had been able to be about her room at least a part of the time. Before that time, she had been able to get about in a specially built low phaeton, the seat of which she filled completely.

Her history, save as reported above, was practically negative. She was of American birth. Her mother died when 60 years of age, from pneumonia; her father, at 76, from an unknown cause. Nothing was known of grandparents, collaterals, nor of a brother and sister. She had never suffered from serious diseases, save as outlined in the history of present condition. Her habits have been good. Menstruation began when she was 13, have been regular, every 28 days, and normal until patient was 45, when the flow ceased. She is the mother of three children, and her pregnancies have been without complications as have labor and the puerperium.

Physical examination. December 17, 1907. The patient has an anxious expression and a staring look. She has worn glasses for the last 3 years. The head is negative, save for many bad teeth. The neck is emaciated, without any palpable glands. The chest is symmetrical in its upper half. The lower portion is distended because of the enormous abdominal tumor, and the lower ribs are markedly everted. The breasts are atrophied. Breathing is rapid and labored. The heart is crowded upward by the tumor, and the apex is displaced into the axilla. The sounds are feeble and not clear.

The abdomen is tremendously distended by an enormous barrel-shaped tumor which completely fills the abdomen, everts the ribs, hangs far over the sides of the back, and extends downward nearly to the knees. Large veins like whipcords lie over the anterior surface. From pubis to xiphoid, the distance is 4 feet, 4 inches. From pubis to the most dependent part of the tumor is 32 inches. The girth at the umbilicus is 6 feet, 10 inches. The abdominal distention is so great that she lies in a semi-recumbent position so that part of the tumor's weight may be carried upon her legs. Quite naturally, neither the liver nor spleen could be palpated.

The anterior thighs are covered by the tumor. An extensive tense œdema involves both limbs from the iliac regions and buttocks downward.

The reflexes are present and normal in the triceps and wrist. They are not obtainable in the lower limbs because of the œdema and immobility due to the weight of the tumor.

By vaginal examination, the uterus is found crowded to the floor of the pelvis, otherwise it appears normal. The pelvic floor is weakened with a cystocele and rectocele. On rectal examination, the tumor is felt crowding down the pouch of Douglas.

The blood is negative save for a well-marked secondary anæmia. The urine is negative, although the specific gravity is only 1,006.

The patient's general condition is not good. She is weak and cachectic. There is tremendous abdominal distention. After 17 years of urging, she finally consents to operation for relief from suffering, with a very bad prognosis given to the family.

Operation. December 17, 1907, at Hahnemann Hospital in the presence of a large audience of invited physicians. As will be seen from the accompanying photograph, the patient completely filled two operating tables placed side by side. She was placed upon her side and the tumor was supported by the second operating table. The tremendous œdema present in the legs is clearly seen in the photograph. After careful abdominal preparation, a trocar was inserted and 24 gallons of a dark syrupy fluid, colloid in character, was removed. After a mid-line incision, the tumor was found to be adherent to the peritoneum. The adhesions were extremely dense and the sac was freed with the very greatest difficulty since it was adherent to the peritoneum throughout, to the liver, the gall-bladder, the spleen, and the intestinal coils.

The tumor arose in the right ovary and was a multilocular cystoma. The fluid in the various compartments was of different colors, black prevailing, and varied in consistency, although the average specific gravity was 1,040. Inspection of the enormous sac showed here and there areas of cystic hæmorrhage. There were no papillomata, although some of the partitions presented evidence of rupture.

The liquid and semifluid contents weighed 202 pounds; the sac weighed 19 pounds, 12 ounces—a total weight of 221 pounds, 12 ounces. The patient weighed just before operation 309½ pounds, so that the patient's net weight devoid of her tumor was 87 pounds, 12 ounces.

She survived the operation less than 1 hour.

A casual review of the literature supports the belief that this tumor is the largest yet reported. Gould and Pyle in their extensive compilation of unusual cases in medicine mention none larger than 182 pounds (Reifenyden's case) while all the others are 150 pounds or less. The texts usually state that the size of the growths is limited only by the distensibility of the abdomen and the resistance of the patient and some (as Penrose) mention without reference that cases attaining a weight of 200 pounds have been recorded.

A careful review, however, reveals five cases 225 pounds or larger, viz.: Binkley 225 pounds, Tuffier 235 pounds, Bullitt 245 pounds, Barlower 298 pounds, and finally Spohn's remarkable case

Photograph of patient lying upon operating table and tumor supported on second table.

in which he estimated the weight of the tumor at 328 pounds. Four other cases of more than 200 pounds are recorded, 29 weigh more than 150 pounds, 78 more than 100 pounds, 191 more than 60 pounds.

Two methods of arriving at the weights of the tumors have been used, yet both are subject to certain inaccuracies. The first adds the weight of fluid removed to that of the sac and when accurately controlled as in our case, is probably perfectly reliable. Yet fluid may be lost at operation, when the exact amount is difficult to determine. In other cases, as Spohn's and Barlowe's, the patients were tapped one or more times before the final removal of the tumor and the amount of fluid due to reaccumulation is of course unknown. Peaslee considers 2 pounds a day a very rapid rate of reaccumulation yet the question is so complex that it is hard to settle. In many of the older cases, which were merely tapped, the weight of the fluid only could be obtained and we must either accept the author's estimate or ignore the weight of the sac, which may be considerable, even up to 50 pounds.

The other commonly used method subtracts the weight of the patient after operation from her weight previous to it. It is, however, rarely possible to weigh a patient immediately after operation, and at a later time her loss in weight from œdema, or her gain in weight from improved nutrition, are factors that must be considered, though fortunately they often counterbalance each other. Ascitic fluid occurs so rarely that it ordinarily need not be considered. Twenty-five pounds, however, would probably be a very liberal estimate of the error by any of these methods of determination and this is a small factor when we consider the enormous weight of the larger tumors.

Of great interest is the fact that, in spite of the progress of modern surgery, 25, or nearly one-third of the total number of cases of more than 100 pounds have been reported within the last 20 years. It may be that the greater rarity of larger tumors prompts us to record a larger proportion of such growths. Yet Spohn's 328-pound case, reported from Texas in 1905, would have been remarkable enough to report in any age, as would Tuffier's 94-liter case, published in 1906, or Pfachler's 97-kilogram growth in 1904, since Peaslee in his monograph of "Ovarian Tumors" in 1872 states: "The largest amount of fluid in an ovarian tumor which has been recorded is 160 pounds, which was drawn off during an operation of ovariotomy by Kimball, more than 20 pounds being still left as he could not complete the operation." Emmett, in 1879, stated, moreover, that "Dr. Keith had removed a tumor weighing 120 pounds, the largest ovarian tumor ever removed successfully from the living body." Nor, as we might suppose, do all the present day cases come from remote districts, since Smith's 192-pound case reported in 1906 had received electricity and Christian Science treatment in Boston, for 2 years prior to her operation. Franz's 160-pound case operation in 1916 lived for years almost in the shadow of one of the larger Berlin hospitals.

As long as people live in superstitious fear of surgery or fall into the hands of charlatans for treatment, these very large tumors will occasionally arise.

TECHNIQUE OF RADIUM TREATMENT OF CANCER OF THE PROSTATE AND SEMINAL VESICLES

By HUGH H. YOUNG, M.D., F.A.C.S., Baltimore
From the James Buchanan Brady Urological Institute, Johns Hopkins Hospital

At the International Medical Congress, London, 1913, in the Section of Urology, Pasteau and Degrais presented a method for the treatment of cancer of the prostate with radium. The technique consisted simply in introducing a silver tube containing radium to which was attached a long wire which was employed to introduce the radium into the catheter to the proper distance, into the urethra, where it was left in place for an appropriate length of time. In Figure 1 the catheter with radium in place is shown schematically. Being impressed with the good results which Pasteau had secured in two cases by this extremely crude apparatus, I secured 102 milligrams of radium element in a glass tube and set about to construct more accurate instruments for the introduction of radium into the urethra, prostate, and rectum. The first instruments employed were provided with a straight cystoscope, the same cystoscope which I had used for several years in the construction of my cystoscopic rongeur (Fig. 2). With this cystoscope as a basis, the instrument shown in Figure 3 was made, and it at once became possible to introduce radium not only into the urethra and rectum, but into the bladder where, under cystoscopic direction, it could be applied to the region desired. It became evident at once that some means of firmly fixing and holding the instrument containing the radium was necessary in order to keep the application against the desired area for the entire period of treatment. Casting about for an instrument, I made use of the cystoscopic clamp or artificial hand which I had employed for several years to hold a photographic cystoscope in place during exposure of the plates. A ball of appropriate size was then placed around the shaft of the radium applicator which, when firmly grasped by the cystoscopic clamp, held the radium instrument in its grasp upon the desired spot. The completed instrument is shown in Figures 3 and 4. This then was the basis for a series of instruments which have since been constructed, the object of which has been to place radium upon a certain spot under the direction of either the cystoscope in the bladder or a finger in the rectum and to hold it there during the entire treatment seance.

It soon became evident that it was not necessary to use the cystoscope for applications of radium in the urethra or at the vesical orifice or even against the trigone, as it is easily possible by simple manipulation to determine where the instrument is in its relation to the vesical neck or to place the radium exactly where it is desired and then hold it there with the clamp. For the rectum the cystoscopic instrument was manifestly not necessary as the radium containing beak could easily be placed at the desired spot along the posterior surface of the prostate or vesicles or along the pelvic wall and held there by the clamp. We, therefore, constructed instruments of appropriate form not containing cystoscopes for treatment through the rectum, urethra, at the vesical neck or through the trigone and base of the bladder to the region of the seminal vesicles.

Figure 5 shows the present form of instrument which is employed for these treatments. The radium is contained in a small platinum tube which is surrounded by a metal cap covered with hard rubber, thus affording screening for both the α- and β-rays, and also the secondary rays. The ball is placed at the end of the rod thus facilitating usage in both rectum, urethra, and bladder, the small handle at right angles to the shaft facilitates operation, and indicates the direction of the beak.

Recently since the introduction by Barringer of the needling method for the treatment of carcinoma of the prostate through the perineum, I have made up in the workshop of the Brady Urological Institute an instrument which contains within the beak four needle points each containing 12½ milligrams of radium surrounded by a cap of silver which is surrounded by gutta percha. This instrument was supplied to and is in use by Dr. John H. Cunningham of Boston. Figure 6, *b* shows the needle with shaft attached for insertion through the perineum.

TECHNIQUE EMPLOYED

In the preliminary study of the cases a careful diagram showing the size and consistence of the prostate is made, utilizing a rubber stamp outline of normal prostate and vesicles as a basis. In making the examination with the finger of the left hand, the outline chart is drawn simultaneously, careful attention being made to get an accurate reproduction of the size and induration of the

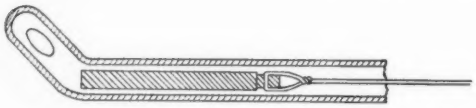


Fig. 1. Catheter method of Pasteau and Degrais for applying radium in cancer of the bladder and prostate.

Fig. 2. Author's cystoscopic rongeur for obtaining sections of vesical tumors for microscopic study.

Fig. 3. Author's cystoscopic radium instrument 1 carrying a tube of radium in fenestrated platinum capsule in beak; closed with obturator.

Fig. 4. Instrument 1 with straight cystoscope introduced.

Fig. 5. Rectal radium carrier, applied under direction of index finger in rectum, and held in place by mechanical hand or clamp.

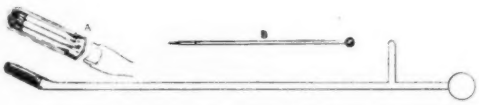


Fig. 6. New radium applicator with enlarged cap, *a*, made to contain four needles containing 12½ milligrams of radium each, which may be used also for needling through the perineum by means of attachable shaft, *b*.

mass. The degree of induration is indicated on a scale of four, blank being normal, parallel lines, slight induration; cross lines moderate induration, and additional cross lines (at 45° to the other two parallel lines) great induration, such as is characteristic of carcinoma. A typical chart of carcinoma of the prostate and seminal vesicles is shown in Figure 7.

If the diagnosis is clear from the extreme induration of a portion of the prostate and the absence of calculus from the X-ray examination, a cystoscopic examination may not be carried out. As a rule cystoscopy is much more painful in cases of carcinoma than in cases of hypertrophy, and if it is not necessary for diagnosis we usually do not insist on cystoscopy. If there is a question as to the diagnosis, cystoscopy is performed and is of diagnostic importance, first, because in cases where hypertrophy is present, the prostatic orifice usually shows no intravesical lobes or enlargement more than a small median bar or minute rounded lobe, and, second, because there is shown by examining with the finger in the rectum and cystoscope in the urethra a marked increase in the suburethral portion of the prostate, not merely in the prespermatic or subcervical group of glands, but also beneath the entire prostatic urethra from the vesical orifice to the apex, and this increase in the suburethral portion of the prostate is usually associated with marked induration. This is based on the pathological fact that prostatic hypertrophy almost never involves the so-called posterior lobe which lies between the posterior capsule and the ejaculatory ducts above and the lower portion of the prostatic urethra below, and that the same region is strangely the point of predilection for carcinoma. This diagnostic sign was first pointed out by me 16 years ago, and has been of great value in the diagnosis of early and doubtful cases.

The diagnosis of carcinoma having been made, the question arises as to whether a radical operation can be carried out with the probability of success. We have now had sixteen cases in which we have carried out our radical technique, and are able to report over 50 per cent apparent cures followed over a period of 5 years or more, and in the last four cases by a modification of technique, through which the preprostatic vessels, nerves, and fascia are preserved intact, complete urinary continence has been obtained.

Experience has shown that in cases in which the carcinoma is confined well within the capsule of the prostate, in which it has involved only the

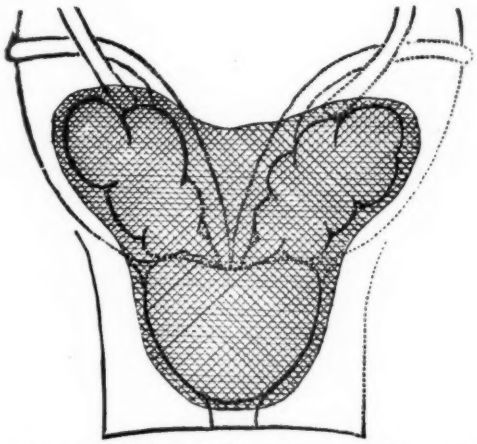


Fig. 7. A typical chart of carcinoma of prostate and seminal vesicles.

lower portion of one or both seminal vesicles, and in which it has not penetrated the prostatic capsule or fascia of Denonvilliers which covers not only the prostate but the seminal vesicles, the radical technique can be carried out with strong probability of a complete cure and a good functioning bladder with perfect control and without urethral stricture at the site of anastomosis.

Unfortunately, the great majority of cases present themselves much too late, the disease has already progressed well up along the sides of the seminal vesicles, and frequently involves the lower pelvic glands, only forming a plateau of marked induration above the prostate in the intervesicular region. In many of these cases there is no marked urinary disturbance beyond a slight residual and some increased frequency, owing to the fact that carcinoma of the prostate tends to invade the structures above, behind the bladder, and does not penetrate or ulcerate until later into the urethra or bladder. On this account operative relief for the obstruction is usually not necessary, and one is free to choose methods of attack upon the carcinoma which is usually producing symptoms due to its size and pressure upon nerves and adjacent structures. The plan of procedure for thorough treatment with radium which was first proposed by me before the American Urological Association at its meeting in Baltimore, 1915, and subsequently presented in a paper(1) has been carried out in over one hundred cases, the results of which will be presented in an accompanying paper by Dr. Clyde L. Deming, resident urologist of the Brady Urological Institute.

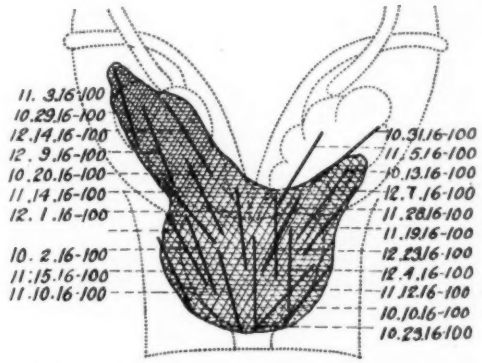


Fig. 8. A case of cancer of the prostate and left seminal vesicle (right vesicle slightly involved). The radium treatments, each representing 100 milligram hours, are shown and date of each is recorded.

In my first paper, Figures 8 and 9, the charts of cases were presented in which 100 milligrams of radium was applied for one hour each by rectum, urethra and bladder to various positions. In one such case it was given twenty-one times through the rectum and fourteen times through the urethra and bladder as shown in Figures 10 and 11. The only modification which has been made in the past 4 years has been to employ an instrument, the beak of which is protected by a gutta percha cap, scrupulous care being taken to avoid applying radium twice in

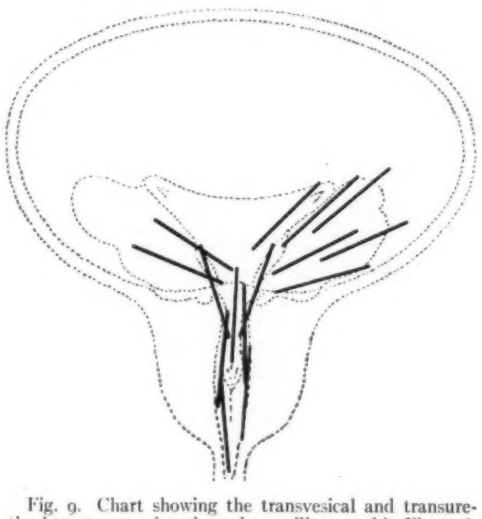


Fig. 9. Chart showing the transvesical and transurethral treatments given in each case illustrated in Figure 8 Each line represents 100 milligram hours.

Fig. 10. Mechanical hand in use in treating cancer of seminal vesicles and prostate through rectum.

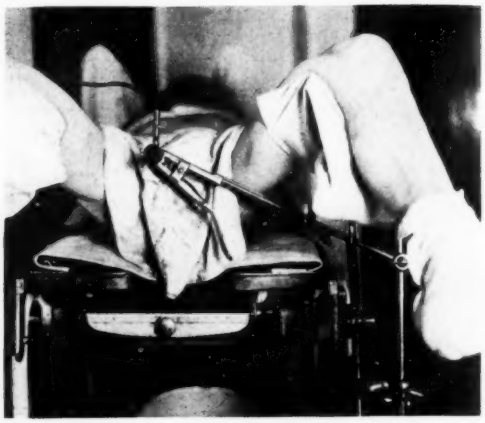


Fig. 11. Mechanical hand or clamp holding radium instrument in position desired.

the same place, generally the successive treatments being given to places quite remote from each other, and alternating between the rectum, urethra, and bladder. Before the introduction of these methods it was freely stated that it was impossible to employ radium in sufficient dosage through the rectum without producing radium burns. By means of this technique, in which the radium is placed in position with the finger in the rectum and held there by the cystoscopic clamp, care being taken to avoid regions that have already been treated until 2 or 3 weeks have elapsed, radium burns and even pronounced irritation have been practically eliminated, so that we now find it possible to give with impunity twenty treatments, 1 hour each, through the rectum with 100 milligrams properly screened in the small applicator above described. The treatments through the urethra (which furnishes at least four or five separate and isolated positions), and through the trigone and lateral portions of the base of the bladder, are of very great importance as only the mucous membrane and submucous tissues separate the radium from the carcinomatous prostate or vesicles. Since the introduction of Barringer's needles, we have added this method of treatment to our routine technique, and now employ two needles at a seance, each of which, containing 12½ milligrams, is inserted through the skin of the perineum (which has been cocanized) into one or both prostatic lobes or even into the carcinomatous mass above the prostate or along the lateral wall of the pelvis in the region of the seminal vesicles (Figs. 12, 13 and 14). These needles are allowed to remain in place for a period varying from 18 to 24 hours. They are introduced under the direction of a finger in the rectum (which should not be covered with glove or finger cot in order to be acutely sensitive to the exact position of the needle). This procedure should be repeated three or four times during the first series of treatments and adds a valuable amount of radiation to the central portions of the prostate and seminal vesicles where it is most remote from the radium applied through urethra, bladder, or rectum. As at present given, one complete series consists of an hourly treatment of 100 milligrams of radium properly screened and applied with the special applicator alternately 20 times through the rectum, 10 times through the urethra, and 10 times through the trigone and also 12½ milligrams 8 times through the perineum. As noted before in these regions there is sufficient area to provide for treatments which do not overlap or repeat at the same spot and therefore do not produce ulcerations. With such a series of treatments most amazing resorption of extensive carcinomatous involvement of prostate and seminal vesicles and tissue adjacent to them is obtained in the majority of cases, and along with it there comes a disappearance of pain and obstruction, a return usually to more normal urination and freedom from straining which is indeed remarkable. Figure 10 shows

Fig. 12. Radium needles being applied. Finger in rectum, determining course and position of needle.

Fig. 13. Sagittal section to show finger in rectum and position of radium needle.

radium applied through the rectum with patient upon his side and the clamp in operation. Figure 13 shows the instrument in place for treatment of the urethra or bladder.

Recently I have constructed an applicator which carries in the beak two tubes of radium, 100 milligrams each, placed end to end and thoroughly screened with 2 centimeters of platinum and a thin layer of gutta percha. This materially shortens the treatment as 200 milligram hours is given each hour with this applicator instead of 100 milligram hours

DETAILS OF TREATMENT

Before mounting the table patient should empty bladder, and if necessary evacuate bowels. For treatments through the rectum no anæsthesia is necessary. For the urethra and bladder it is well to inject 4 per cent procaine before introduction of radium applicator. In very painful cases it may be desirable to give a sixth of a grain of morphine or opium suppository one-half hour before treatment. In some cases treatments can be given twice a day, but usually the patient objects and one treatment of 1 hour each day is all he will take. We usually alternate between urethra, rectum and bladder, picking each time an invaded region which has not been previously treated. The record of treatment is made upon either the prostatic or urethral and bladder chart, as shown in the accompanying cases. A line is drawn showing exactly where the radium was applied and the date is indicated on the line which points to the site of application. The treatments through the perineum with needles is indicated in a similar way upon a third chart, thus the entire treatment is recorded simply upon one page, and the operator can determine at once the location to be treated next in order to avoid overlapping and consequent burning. Another series of rectal charts, four in number, are made two weeks apart. These show the progress of the case and often demonstrate remarkable disappearance of extensive infiltration and induration, as shown in some of the cases charted below. The subject of results, however, will be left to Dr. Clyde L. Deming, who will present a careful study of over one hundred cases. It is necessary to explain that during the period of the war the vigorous attack which had been outlined in our first paper was not carried out, and many of the cases in which Dr. Deming is forced to report received inadequate treatment but they may b used to show the imperfect results obtained by insufficient treatment and to be contrasted with those which have been thoroughly radiated, according to the method above outlined. In a certain proportion of cases, probably 10 per cent, obstruction persists, and the presence of residual urine and frequent urination necessitated operative removal of the obstruction. In these

Fig. 10. Mechanical hand in use in treating cancer of seminal vesicles and prostate through rectum.

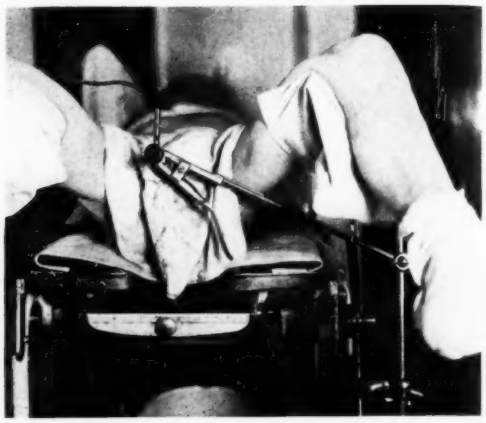


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Fig. 14. Radium needles in position.

cases I have pursued a plan which I have employed in carcinoma of the prostate (associated with hypertrophy or with great obstruction) since 1905, viz., conservative perineal prostatectomy with enucleation of the obstructing median and lateral lobes and careful preservation of the urethra and ejaculatory ducts. Almost invariably the patient is given as thorough a treatment as possible with radium through the rectum, urethra, and bladder before the prostatectomy is carried out. During this course of radium treatment in most cases the obstruction disappears, but in others operation is necessary and the results obtained are generally functionally as good as in benign hypertrophies. In some cases radium is introduced into the prostatic cavities at operation, but care must be taken to protect the rectum by sponges and rubber protective which hold the radium sufficiently far away from the rectum.[1]

RÉSUMÉ

In conclusion it may be said that by the technique which we have above outlined really remarkable results are often obtained in apparently incurable and very extensive cases of carcinoma of the prostate and seminal vesicles. Extraordinary functional results are sometimes obtained with relief of pain, hæmaturia, difficulty and frequency of urination, and attending discomforts. In some cases apparently radical cures have been obtained, but time is yet too short to pronounce definitely upon this point. Suffice it to say that in a desperate class of cases, a great boon can often be furnished and their remaining months or years at least made far more comfortable.

REFERENCES

1. The use of radium in cancer of the prostate and bladder, a presentation of new instruments and new methods of use. J. Am. M. Ass., 1917, lxviii, 1174.
2. Young, Hugh H., and Frontz, W. A. Some new methods in the treatment of carcinoma of the lower genito-urinary tract. J. Urol., 1917, i, 6.
3. Young, Hugh H. The use of radium and the punch operation in desperate cases of enlarged prostate. Ann. Surg. 1917., May.

[1] In a recent case of carcinoma of the prostate and right seminal vesicle, I first made a perineal incision and exposed the posterior surface of prostate and vesicles as in perineal prostatectomy (without opening the urethra) and then introduced bare tubes of radium emanation, 1 m.c. in amount, one cm. apart. No difficulty was experienced in implanting the tubes over the entire area of induration, and also well above the vesicles. This method would seem to furnish a very accurate method for radical treatment with radium.

RESULTS IN ONE HUNDRED CASES OF CANCER OF PROSTATE AND SEMINAL VESICLES, TREATED WITH RADIUM

By CLYDE L. DEMING, M.D., Baltimore
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I. Results of Radium Treatment in 100 Cases of Cancer of Prostate and Seminal Vesicles

By the use of surgical, internal, and autoserum therapy, science has failed thus far to produce satisfactory results in the treatment of extensive carcinoma of the prostate. As a consequence, medicine has turned its attention in another direction, namely to the use of radium. Many institutions have been using radium for a number of years, and now private physicians are tempting its healing qualities. The many details of this treatment are by no means well understood as indicated by the different forms of radium used, the amounts used, and the large number of instruments invented for its application. Yet, the world having been aroused by the great possibilities of the γ-rays, is anxiously awaiting results concerning the cure of this fatal disease. Like the surgical results for cancer, so with the results of radium we must be content to wait a reasonable length of time before a cure can be definitely determined. Prostatic cancer is one of the slowest growing malignancies, and even after an elapse of 4 or 5 years after treatment, we may not be justified in pronouncing a cure. Hence, we must expect results will be given with a great deal of caution. However, we feel that the time limit is past and we are apprehensive to receive the results which have already been obtained.

The paper by Dr. Hugh H. Young on "Technique of Radium Treatment for Cancer of the Prostate and Seminal Vesicles" shows an evolution in the technique of applying this means of treatment which has been devised by him at the James Buchanan Brady Urological Institute. The growth of this therapy, like the development of many medical problems, has profited by its mistakes. The results during such progression must be expected to show variation. This paper shows the results obtained at the Brady Institute in 100 cases of prostatic cancer treated with radium.

The statistics extend over the war period during which time the great care and precision of treatment could not be carried out. Some cases were receiving too large doses at one sitting, while others were receiving too frequent treatments in the same area, and still others were receiving inadequate doses. All cases included in this series were patients with advanced and extensive cancer who were considered beyond the operable stage.

The study of incidence of these 100 cases shows that the youngest to develop such an advanced type of cancer was 45 years and the oldest was 84 years. The largest percentage of cases is found in the seventh decade which includes 45 per cent. Thirty-five per cent occur after this decade and 80 per cent after the sixtieth year.

TABLE I.—AGE ON ADMISSION FOR TREATMENT

No. of Cases	Year	Percentage	Decade
3	45th to 50th	3	Fifth
17	51st to 60th	17	Sixth
45	61st to 70th	45	Seventh
25	71st to 80th	25	Eighth
10	81st	10	Ninth

The diagnosis of cancer was made in all cases by rectal examination. All cases presented the same physical findings as did 175 others which were operated on in this clinic, and all proved microscopically to be cancer. The prostate was enlarged, broad, irregular, nodular, fixed, and stony hard. The seminal vesicles, when invaded, were found broad, flat, indurated, forming an intravesicular plateau. In many of the cases lymph glands were palpated along the lateral walls of the pelvis. The seminal vesicles were involved in 90 per cent of the cases. The membranous urethra was invaded in 51 per cent. It was broad, hard, firm, and in some cases presented a tubular-like growth. The rectal wall was invaded in 15 per cent of cases. No ulcerations were found in the rectal mucosa. All cases then were typical of extensive cancer growth.

The amount of radium used varied greatly, ranging from 300 to 6225 milligram hours, the average being 1600 milligram hours, but this average is no criterion for ideal results as will be shown later in this paper. The radium was given in courses or series extending over a period of 4 to 6 weeks after which there was an interval of

rest for 2 to 3 months when the second series was given. The largest number received only a single series, while a few received as many as five series extending over a period of 2 years.

The treatments were administered per rectum, per urethram, and per vesicam, and a combination of these as described by Dr. H. H. Young (1). Fifteen received rectal treatments alone, three urethral alone, and one intravesical alone. Fifty received a combination of rectal and urethral, 26 a combination of rectal, urethral, and intravesical; 3 rectal and intravesical; 2 urethral and intravesical—in all 99 received rectal treatments, 83 urethral, and 31 intravesical.

RESULTS

In studying the results of radium treatment of carcinoma of the prostate, we find that they naturally fall into four groups: (1) *Symptomatic and functional*, where the frequency, dysuria, hæmaturia, dribbling, and the size and force of the stream have improved or returned to normal; (2) *local*, where there is a change in the size and consistence of the prostate and seminal vesicles; (3) *good* results or lasting results after 4 years of complete subsidence of all the symptoms, and where the prostate and seminal vesicles no longer present the characteristics of malignancy, but are soft and elastic; (4) those cases which showed *no relief* of symptoms and no actual change in the prostate and seminal vesicles.

SYMPTOMATIC AND FUNCTIONAL

Symptomatically, the results from radium have been most remarkable. Seventy-seven per cent of the cases show a relief of some or all of the symptoms. Patients who have been suffering from marked frequency, occurring every 10 to 60 minutes day and night, others who have hesitancy and pace the floor only to void very small amounts of bloody urine with a much diminished stream, and still others who have constant pain in the back and thighs, have been completely relieved. Striking are the results in those cases who have had a suprapubic cystostomy for relief of complete obstruction, when, after a series of treatments, the wound spontaneously healed and the patient gradually developed a normal act of micturition. The mental anxiety associated with these cases must not be forgotten. Many of the patients resume their normal mental status and gain weight and strength after a course of treatment.

Hæmaturia. Blood in the urine was present in 17 per cent of the cases. This was due to the extension of the tumor through the bladder or urethra. Radium applied to these surfaces caused an immediate cessation of bleeding similar to application of radium to the surfaces of bladder tumors or to the cancer of the cervix. All of the cases responded within a week or 10 days or after two to four treatments.

No. 4977 was a patient aged 68 who had hæmaturia for 6 months. The bleeding was present at each urination but varied its appearance, occurring sometimes at the beginning and sometimes at the ending of urination. Rectal examination proved the cancer to involve the posterior half of the prostate and the whole of both seminal vesicles. Cystoscopy showed the cancer breaking through the trigone. On March 24, 1916, 100 milligrams of radium were applied to the right side of the trigone and 50 milligrams to the left side. On March 27, 100 milligrams were applied to the left side. All treatments were given intravesically. The patient was next seen on April 3rd. Hæmaturia had entirely subsided. Patient lived for one year, dying of general carcinomatosis, although he received a total of 2900 milligram hours of radium. He never had a recurrence of blood in the urine and lived a comfortable life except for pain in back during the last 2 weeks of life. Such is the record of those complaining of hæmaturia. All of them responded immediately to the treatment and were permanently relieved.

Complete retention. Complete obstruction to urination was noted in 17 cases. (Several of these cases were able to pass a few drops of urine, perhaps an ounce in 24 hours.) They were being catheterized regularly by themselves or by physicians. Catheterization was painful in most of the cases as they had a marked cystitis together with urethritis. The urethra in these cases is unlike that seen in benign prostatic hypertrophy cases in which the urethræ are encroached upon by large, soft, and elastic lobes, causing potentially enlarged urethræ, while in the carcinoma cases the caliber of the urethræ is smaller than normal. It is firm and rigid due to the infiltration of the suburethral tissues by the tumor. Radium in these cases has produced remarkable results. Fifteen of them began to void after twelve or fourteen treatments. Seven were completely relieved of residual urine, while 8 showed a diminution which varied from 10 to 50 cubic centimeters. Two were unable to void after 2100 milligram hours. These two were obstructed due to benign median lobes. Where there is much hypertrophy, the result of radium on obstruction and residual is not so pronounced.

No. 5445 was admitted with complete retention. He was 80 years of age. History of urinary symptoms dated over a period of 2 years. He had residual urine of 400 cubic centimeters. The prostate was considerably larger than normal, irregular, indurated, and stony hard. The right seminal vesicle was corded, irregular, and adherent. The left seminal vesicle was an inch broad, flat, indurated, and extended upward as far as the finger could reach. There was an intervesicular plateau. The membranous urethra

was obscured by adhesions and by the low position of the prostate which was invaded by the tumor. There were no enlarged glands felt. The rectum was smooth and moved freely over it. Radium was applied, 600 milligram hours to the rectum, 600 milligram hours in the urethra, and 200 milligram hours intravesically in a period of 6 weeks. Two weeks after the beginning of treatment the patient voided small amounts of urine. At the end of the series, patient was voiding all his urine. Urinations occurred every 3 to 4 hours without hesitancy, urgency, or dysuria. The size and force of the stream was almost normal. Rectal examination at this time showed great reduction in the area of induration in both the prostate and seminal vesicles, and one would not recognize the condition as one of carcinoma. The patient's urinary condition returned to normal and remained normal for 4 years. His general condition improved and he gained 15 pounds in weight. Patient has not been examined for 2 years but replies to questionnaire that he voids every 3 to 4 hours without difficulty.

Still more remarkable are those cases which have had a suprapubic cystostomy for complete retention. Radium applied in these cases produces a restoration of urination through the urethra with a good-sized stream and complete control together with healing of the suprapubic wound.

No. 7684 had a month previous to admission a suprapubic cystostomy for complete retention. All the urine was draining through this wound. After a series of radium treatment extending over a period of 6 weeks, the wound was entirely healed and the patient voided with a good-sized stream every 3 hours. No. 8271 had had 6 weeks previously a suprapubic drainage for complete obstruction due to carcinoma of the prostate and seminal vesicles. After receiving 700 milligram hours per rectum, 300 milligram hours per urethram, and 800 milligram hours per vesicam, patient was able to void naturally. Urinations occurred every 3 hours during the day and every 4 hours at night. The wound closed and the patient gained 25 pounds during the next 3 months. No. 8719 had a perineal prostatectomy 2 years previous to admission and 6 months later the wound opened and began to discharge urine. Examination showed that he had an extensive carcinoma of the prostate, seminal vesicles, and urethra. After 6 weeks of treatment, during which time he received 2700 milligram hours of radium, 1800 per rectum, 500 per urethram, and 400 per vesicam, the fistula closed and he voided freely through the urethra.

Residual urine. Sixty-six cases had residual urine, varying from 50 cubic centimeters to 700 cubic centimeters. About the third week of radium treatment, the size and force of the stream began to increase and the residual urine gradually became less. Eighty-five per cent of the 66 cases were entirely relieved and were able to empty their bladders completely. Thirteen per cent showed a diminished residual, while 2 per cent did not show any change. No. 7521 had 400 cubic centimeters residual urine on admission. After 6 weeks of radium treatment, during which time 1400 milligram hours were given, the residual urine had entirely disappeared and patient was voiding with ease. Since 60 per cent of the cancer cases had an infected urine, the relief of this residual adds greatly to the comfort of the patient and likewise removes the great possibility of a septic process supervening a malignancy.

TABLE II.—IMPROVEMENT IN SYMPTOMS

Before Treatment		Result of Treatment		
Symptoms	Percentage Present	Percentage Entirely Relieved	Percentage Improved	Percentage Unimproved
Frequency	96	57	25	18
Nycturia	95	57	25	18
Dysuria	80	90	—	10
Hæmaturia	17	100	—	—
Hesitancy	65	80	7	13
Dribbling	76	75	5	20
Small stream	87	74	6	20
Complete retention	21	95	—	5
Residual urine	61	85	12	3
Pain in back	28	60.7	—	39.3
Pain in extremities	22	59	—	41
Loss of weight	14	57.1	—	42.9

Hesitancy. Delay in starting the urinary stream was noted in 65 cases. In 80 per cent of these it cleared up completely; 7 per cent were improved, and 13 per cent remained uninfluenced by the radium-rays.

Dribbling. Seventy-six patients gave a history of dribbling of the urine either at the beginning, during, or at the end of urination. In 75 per cent of these this symptom entirely subsided, while 5 per cent were improved and 20 per cent remained unaffected.

Size and force of stream. There was a larger percentage of cases who showed an impairment in the size and force of the urinary stream. While many of these patients had dribbling, there were some who had only a diminished size of stream and voided with little force. The statistics show that 87 per cent voided with much diminished size and force of stream. The effect of radium is practically the same as that on dribbling (75 per cent relief). The relief of this symptom is one of the earliest signs of improve-

ment. Usually after 10 to 12 treatments, there is a notable difference with regard to the ease with which the stream starts and the force with which it flows. Both improve gradually, the maximum time limit for improvement being about 6 to 8 weeks after the termination of the treatment.

Frequency and nycturia. Frequency is one of the first symptoms to appear in cancer of the prostate. It was the most common symptom to be noted in the 100 histories. Frequency and nycturia were present in 96 per cent and 95 per cent respectively. There are, of course, many degrees of frequency, but in this classification are included all cases who voided oftener than 3 hours. Some of the more severe cases voided every 5 to 10 minutes. Fifty-seven per cent of the cases were cured of this frequency. In this group are classed all those patients who, after treatment, voided not oftener than every 4 hours during the day and who were able to retain urine at night 8 hours without discomfort. Twenty-five per cent were improved so that they voided not more frequently than every 2 to 3 hours during the day and did not have to get up more than twice at night. Eighteen per cent did not show any improvement. Some patients showing reaction to radium began to void less frequently after the third week and continued to improve, while others did not show any improvement until after the series had ended. This can be explained from our study of sections of prostates which have been removed at operation at different intervals after radium treatment. During the first 2 weeks there is considerable œdema of the tissues, especially of the parenchyma, and then there is a gradual change to fibrosis and a disappearance of the cancer cells. When the fibrous change begins, there is a shrinking of the tissues with the result of diminished pressure on the urethra and internal vesical orifice. We have noticed in a few cases an increase of frequency for a few days at the beginning of treatment and occasionally complete obstruction for a few days. This period of exaggeration of symptoms corresponds to the œdematous stage of the tissues.

No. 6759 was admitted with frequency every 30 to 60 minutes day and night. The patient received 1300 milligram hours per rectum and 200 per urethram. Three months after beginning of the treatment he was able to retain urine for 6 to 10 hours and voided with a normal-sized stream.

No. 8718 had on admission a frequency of every hour day and night. In 7 weeks he had 2700 milligram hours of radium, 500 to the urethra, 400 intravesically, and 1800 to the rectum. He had slight increase for the first 3 weeks and then the intervals between urination began to lengthen, and after 2½ months he was voiding at normal intervals.

Dysuria. Pain in the form of strangury was generally relieved after a few treatments. Burning and smarting in the posterior urethra and neck of the bladder also were greatly ameliorated. Eighty per cent of the cases complained of painful urinations. Ninety per cent of these were free from pain after the first series. The 10 per cent who failed to respond all received small amounts of radium, less than 1200 milligram hours. The dysuria usually subsided when the size of the stream increased. Some of the cases were very much improved after five treatments. It is impossible to explain so early a result due to radium. It is feasible, however, to believe that passage of cystoscope or the radium applicator might cause a dilatation of the urethra and the improvement of the act of urination. But the greater part of the result came during the fourth and fifth weeks when the rectal examination showed a softening of the prostatic tissues.

No. 6759 complained of severe burning, hesitancy, dysuria, dribbling, and frequency of every hour day and night on admission, March 2, 1916. On April 6, he had very slight irritation in the neck of the bladder which lasted until May 1. During this time he had received 1800 milligram hours of radium. Patient could then hold urine 6 hours during the day and for 10 hours during the night, and voided with natural ease.

Pain in the back and extremities. Dull aching pain in the small of the back was noted in 28 per cent of the cases. This pain was present day and night, regardless of position. It never radiated to the shoulders; it either was stationary or was referred down the thighs, especially on the outer side. Sixty and seven-tenths per cent of these cases reported an entire relief of the pain. The remainder were very little, if any, improved. X-rays were taken of most of the cases. About 65 per cent of the patients who complained of pain in the back showed metastases. The fact that metastases were present did not appear to influence the effect of radium locally.

No. 8493 was admitted complaining of pain in back, right hip, and groin. Nineteen hundred milligram hours of radium were given, 1100 per rectum and 800 per urethram, in 8 weeks. X-ray showed bones of pelvis, especially both ilia, to have evidence of general metastatic carcinoma. The bones were thickened and roughened. The lumbar vertebræ showed a marked thickening of the spine. Pain never disappeared entirely but was ameliorated, and the patient was fairly comfortable and did not require morphia. He voided every three hours during the day and every four hours at night.

In most cases pains in the extremities were described as an aching sensation, weakness, like a hot iron passing over the thighs and like

TABLE III.—CASES RECEIVING ONLY 1 SERIES OF RADIUM

No.	Milligram Hour	Frequency	Duration of Series	Symptoms Improved	Local Improvement	Irritation
1	1000	2-d	3-w	+	+	−
2	550	2-d	2-w	−	−	−
3	800	3-d	2-w	+	+	+
4	1050	2-d	4-w	++	−	−
5	1200	2-d	3-w	−	−	−
6	1100	2-d	3-w	−	−	−
7	1100	3-d	4-w	+	−	−
8	1300	2-d	4-w	++	−	−
9	800	3-d	4-w	+	−	−
10	2600	2-d	7-w	+++	+++	+
11	500	2-d	10-d	−	−	−
12	1000	3-d	4-w	−	−	−
13	600	2-d	3-w	−	−	−
14	600	2-d	10-d	−	−	−
15	600	2-d	2-w	−	−	−
16	850	3-d	4-w	−	−	−
17	250	3-d	10-d	−	−	−
18	800	3-d	3-w	+	−	−
19	400	2-d	1-w	−	−	−
20	800	3-d	3-w	−	−	−
21	1300	3-d	6-w	−	−	−
22	1600	3-d	7-w	++	+	−
23	1400	2-d	4-w	−	−	−
24	1900	3-d	8-w	+++	−	+
25	450	5-d	2-w	−	−	−
26	700	7-d	4-w	+	−	−
27	420	1-d	1-d	−	−	−
28	400	2-d	2-d	−	−	−
29	200	1-d	1-d	−	−	−
30	1050	7-d	6-w	+	+	−
31	400	5-d	2-w	+	−	−
32	700	14-d	6-w	+	−	−
33	865	14-d	4-w	−	−	−
34	200	1-d	1-d	−	−	−
35	1700	6-d	8-w	+++	++	−
36	1300	2-d	6-w	++	−	−
37	1525	4-d	6-w	++	−	−
38	2050	3-d	7-w	+++	++	−
39	700	3-d	3-w	+	−	−
40	1850	2-d	8-w	+	+	−
41	2500	2-d	8-w	++	++	+
42	309	1-d	1-d	−	−	−
43	400	2-d	8-d	+	−	−
44	420	7-d	4-w	+	−	−
45	330	7-d	1-w	−	−	−
46	1800	3-d	7-w	++	+	+
47	1200	2-d	4-w	+	−	+
48	2100	3-d	8-w	+++	++	+
49	1315	2-d	4-w	++	+	−
50	1625	14-d	9-w	++	+	−
51	1445	3-d	6-w	++	−	−
52	1500	3-d	6-w	−	−	+
53	2975	3-d	8-w	+++	++	−
54	2100	3-d	8-w	++	++	−
55	1000	3-d	4-w	+	−	+
56	600	2-d	2-w	−	−	−
57	900	3-d	4-w	+	−	+
58	2800	3-d	7-w	+++	+++	+
59	800	3-d	3-w	+	−	−
60	400	2-d	1-w	−	−	−
61	700	2-d	2-w	+	−	−

TABLE III.—*Continued*

No.	Milligram Hours	Frequency	Duration of Series	Symptoms Improved	Local Improvement	Irritation
62	900	2-d	3-w	+	−	−
63	700	3-d	3-w	−	−	−
64	1000	3-d	4-w	+	−	−
65	1200	4-d	7-w	+	−	−
65				39	16	11
65	1045	3-d	4-w	60%	23%	17%

NOTE: d = day
2-d = treatments given every 2 days.
3-d and 4-d = treatments given every 3 and 4 days.

flesh being pulled from the bones. They were mostly referred to the outer side but rarely to the inner side of the thighs; always to the muscles and never to the joints. Extremity pains were present in 22 per cent of the cases. Fifty-nine per cent of these responded to treatment, while 41 per cent showed no improvement. The improvement is probably due to resorption of the infiltration which involved nerves in the lower pelvis.

Loss of weight. Fourteen patients complained of loss of weight, ranging from 10 to 50 pounds. Most of the patients were professional men and sought relief before the picture of cancer was implanted on their external features, so that the marked anæmia, emaciation, and cachexia were rarely seen. The general health of most of the patients improved after radium treatment. Appetite returned to normal and the general physical condition became distinctly elevated. Fourteen of the cases gained weight varying from 8 to 25 pounds. The feeling of betterment usually began about the second week and continued, depending on the symptomatic result. Some patients continued to lose weight and strength, especially those who were in the later stages of the disease with signs of metastases in groins or elsewhere.

LOCAL RESULTS

The local result of radium on prostatic cancer is expressed by a change in the consistence and diminution in the size of the prostate and seminal vesicles. While the local results are not so remarkable as the symptomatic, the examining finger detects a most gratifying condition. Since the evolution of treatments has undergone many changes in technique, one would expect a variation of results which is readily borne out in the tabulations.

In 55 of the 100 cases a marked change in the size and consistence was demonstrated. The hard stony-like character was changed to a much less indurated tissue with a definite elasticity. The prostate itself became normal in size and the vesicles smaller and movable. The hard plateau gradually disappeared, leaving a sensation of a chronic inflammatory condition. The hard nodules when present in these cases melted away. The palpable glands along the side of the pelvis became indistinct and non-palpable.

TABLE IV.—SIXTY-FIVE CASES RECEIVING ONLY 1 SERIES OF TREATMENTS

No. Cases	Symptoms	Size of Prostate	Average Milligram Hours	Percentage Improved	Percentage not Improved
26	no response	no change	625	0	100
39	improved	no change	999	60	40
16	improved	decreased	1415	23	77

No. 5818 showed on admission a very large, adherent, irregular, nodular, stony-hard prostate with the process extending upward and involving the seminal vesicles. There was also a definite fixation of the prostate with the formation of an intervesicular plateau. The patient received in 2 months 2400 milligram hours per rectum and 400 per urethram, making a total of 2800 milligram hours. At the end of the series the prostate was normal in size, adherent, and chronically inflamed. There was nothing to suggest malignancy. The stony character had entirely disappeared; fixation of the structures was replaced by a definite degree of mobility. Some of the cases showed a subsidence of the hard character without a diminution in the size of the mass.

A number of these cases were operated upon and found to be benign hypertrophies coexistent with carcinoma. The radium usually affected the cancer tissue, but failed to produce any marked change in the benign hypertrophy.

The cases showing local result were given 1000 to 6225 milligram hours of radium. One to five series were administered over a period of 6 weeks to 2 years. Thirty-one cases received only one series of treatment and averaged 2300 milligram hours. Eleven received 2 series averaging 2500 milligram hours; 6 received 3 series, averaging 2900 milligram hours; 5 received 4 series, averaging 3000 milligram hours; and 2 cases received 5 series, 5227 milligram hours and 6225 milligram hours respectively. Many of these treatments were given 1 to 3 days apart with an interval of several months between series. Doubtless much better results might have been obtained had the more recent technique of treatment that is now in vogue been carried out.

The changes in the tissue occur usually about the third to the fifth week. This change can be detected shortly after the onset of symptomatic improvement. Cases vary to some degree on this point, but as a rule it can be detected near the end of the first series. Cases which had seminal vesicle involvement showed similar changes, provided radium was directed over them. It was formerly thought difficult to obtain changes in the vesicles, but it is now known that the treatments were not accurately given in these regions. A great deal can be accomplished by placing the radium intravesically over the seminal vesicles as well as high up in the rectum.

Tables III and IV show result in those cases receiving a single series of treatments. It will be readily seen that those cases which showed no response to radium received the smallest amount, while those which showed a symptomatic improvement received a larger amount and those which showed local effect or a change in the size of the tumor received a still larger amount. It is apparent that more radium is required to produce a demonstrable change in the carcinoma than to affect the symptomatology. Table IV does not indicate the degree of improvement of the symptoms and change in the prostate; for none of them received enough radium to produce a complete subsidence of all the symptoms or complete resorption of the cancer tissue.

Table IX shows that the greater the number of series the greater was the percentage of local improvement. The average amount of radium was progressive as the series advanced and it was not until 3000 milligram hours were given that the cases showed a 100 per cent symptomatic and local improvement. This amount does not necessarily mean that these patients have been cured, as different patients react differently and no two show the same status of cancer involvement. All cases receiving this amount showed some degree of improvement in symptomatic and in the local condition.

FIVE CASES SHOWING GOOD RESULTS

There were a few cases which apparently responded to radium in a remarkable manner. The immediate results were excellent. They were entirely free from symptoms and rectal examination showed regression of the tumor so that the prostate was normal in size. These patients have enjoyed apparently perfect health for 4 years: two have had a recurrence of symptons and three remain perfectly well after this interval. The amount of radiation has been large in all these cases.

TABLE V.—CASES RECEIVING 2 SERIES OF RADIUM

No.	First Series		Interval	Second Series		Total		Results		
	Milligram Hours	Duration		Milligram Hours	Duration	Milligram Hours	Duration	Symptoms	Local	Irritation
1	2000	4-w	4-w	780	1-w	2780	2.5-m	+++	++	+ sl.
2	2600	5-w	12-w	2000	10-w	4600	6 -m	+++	+++	+ sl.
3	1050	4-w	2-w	675	1-w	1725	2 -m	−	−	−
4	2100	3-w	12-w	500	4-d	2600	4 -m	+++	++	+ sl.
5	750	3-w	2-w	900	2-w	1650	2 -m	+++	+	−
6	700	2-w	4-w	800	2-w	1500	2 -m	+	+	−
7	600	2-w	4-w	800	2-w	1400	2 -m	++	−	−
8	600	2-w	8-w	800	2-w	1400	3 -m	+	+	+
9	900	3-w	12-w	1200	4-w	2100	5 -m	−	−	−
10	300	3-d	12-w	500	5-d	800	3 -m	++	−	−
11	500	1-w	26-w	250	1-d	750	6.5-m	−	−	−
12	1200	3-w	12-w	700	2-w	1900	4.5-m	+	−	−
13	1600	3-w	8-w	500	10-d	2100	3 -m	+++	+	−
14	1000	3-w	12-w	500	5-d	1500	4 -m	++	+	−
15	900	3-w	12-w	500	2-w	1400	5 -m	−	−	−
16	1200	5-m	20-w	600	8-w	1800	12 -m	−	−	−
17	3070	5-m	16-w	2200	8-w	5270	10 -m	+++	+++	−
18	450	3-w	8-w	450	1-w	900	3.5-m	−	−	−
Averages	1248	4.4-w	10-w	786	2-w	2065	4.3-m	66.6	50.0	22.2

d = day. w = week. m = month. sl. = slight.

TABLE VI.—CASES RECEIVING 3 SERIES OF RADIUM

No.	First Series		Interval	Second Series		Interval	Third Series		Total		Results		
	Milligram Hours	Duration		Milligram Hours	Duration		Milligram Hours	Duration	Milligram Hours	Duration	Symptoms	Local	Irritation
1	1200	3-w	5-w	400	2-w	7-w	500	4-w	2100	5-m	+++	+++	−
2	2160	6-w	6-w	885	1-w	3-w	265	1-d	3290	5-m	+++	+	+
3	725	2-w	10-d	1115	3-w	3-w	920	3-d	2760	3-m	+++	+++	+
4	1400	4-w	10-w	300	1-w	3-m	500	1-d	2200	7-m	++	−	+
5	1300	4-w	1-w	750	3-w	7-w	675	2-w	2725	4-m	+	++	−
6	1200	6-w	5-w	400	2-w	9-w	400	3-w	2000	6-m	−	−	−
7	800	12-d	4-w	600	8-d	6-m	600	10-d	2000	8-m	−	+	+
8	1800	4-w	6-w	900	3-w	6-w	400	8-d	3100	5-m	+	++	+
9	400	3-w	2-w	700	6-w	2-w	600	4-w	1700	5-m	−	+	−
10	1450	2-w	6-w	1100	3-w	4-m	400	3-d	3150	7-m	++	−	−
	1243	3.6-w	4.7-w	735	2.5-w	9.1-w	536	1.7-w	2503	5.6-m	70%	70%	50%

No. 5230, 72 years of age, was admitted June 21, 1916 complaining of difficult urination. History dated over a period of 3 to 4 years, beginning with frequency, hesitancy, and dysuria. The frequency had increased so that he was voiding about every hour. Dysuria was the dominating symptom. Six weeks before entry to the hospital complete retention occurred. On admission rectal examination showed a markedly enlarged prostate. It was smooth and elastic, although the impression given was that of an underlying markedly indurated posterior lobe which was malignant. The outlines of the prostate could not be distinctly made out. The mass extended well up on the left to the left wall of the pelvis and was densely indurated and adherent. The right lobe of the prostate was not so markedly enlarged. The right seminal vesicle was invaded in its lower portion, densely indurated and adherent. Along the outer portion of the left lobe there was a hard nodular area. The membranous urethra was involved in a mass of marked induration. The lower portion of the prostate and that part extending up over the left lobe was practically of stony hardness. The bladder wall above the upper confines of the prostate was soft and yielding. He was treated by retention catheter and given radium to the amount of 2050 milligram hours, 200 milligram hours of which were given through the urethra, the remainder of which was applied through the rectum during the following 8 weeks. At the end of 6 weeks the patient was voiding at rather frequent intervals but without pain. He was then given 200 milligram hours per urethram which caused a temporary obstruction. Rectal examination at the end of 8 weeks showed the mucosa of the rectum to be only slightly thickened.

TABLE VII.—CASES RECEIVING 4 SERIES OF RADIUM

No.	First Series		Interval	Second Series		Interval	Third Series		Interval	Fourth Series		Total		Results		
	Milligram Hrs.	Duration		Milligram Hours	Duration		Milligram Hours	Duration		Milligram Hours	Duration	Milligram Hours	Duration	Symptoms	Local	Irritation
1	875	2-w	7-w	350	1-d	6-w	1135	10-d	3.5-yr.	700	1-w	3160	3½-y.	++	+++	–
2	1460	4-w	3-w	700	2-w	2-w	960	4-w	2-m	200	2-d	3320	9-m	+++	+++	+
3	980	2-w	2-w	325	5-d	5-w	500	10-d	2-m	1100	3-w	2905	5-m	+++	+++	–
4	700	2-w	13-w	600	10-d	6-m	600	10-d	14-m	1800	6-w	3700	2-yr.	+++	++	+
5	700	2-w	5-m	300	5-d	4-m	600	2-w	12-m	500	8-d	2100	22-m	+++	++	+ sl.
	943	2.5-w	9-w	455	5.6-d	2.5-m	759	2-w	15-m	860	2.2-w	3037	20-m	100%	100%	60%

TABLE VIII.—CASES RECEIVING 5 SERIES OF RADIUM

No.	First Series		Interval	Second Series		Interval	Third Series		Interval	Fourth Series		Interval	Fifth Series		Total		Results		
	Mg. Hr.	Durat'n		Mg. Hr.	Durat'n		Mg. Hr.	Durat'n		Mg. Hr.	Durat'n		Mg. Hr.	Durat'n	Mg. Hr.	Durat'n	Symptoms	Local	Irritation
1	1100	4-w	3-w	1400	5-w	6-w	900	4-w	4-w	1550	4-w	6-w	1275	3-w	6225	8.5-m	+++	+++	+
2	1100	2-w	11-m	500	1-w	4-m	700	1-w	3-m	400	4-d	4-m	1000	2-w	3200	24-m	+++	++	+
	1100	3-w	6-m	850	3-w	2.7-m	800	2.5-m	2-m	975	2.5-w	2.7-m	1135	2.5-w	4712	16-m	100%	100%	100%

The prostate was very little larger than normal. The consistence was rather elastic and would impress one, feeling it for the first time, as a moderate grade of benign prostatic hypertrophy. The right lobe was a little more indurated than normal, particularly on the periphery. Otherwise, the consistence of the prostate showed nothing which indicated malignancy. The seminal vesicles were just palpable; they were soft and elastic. During the next year the patient gained 17 pounds and general health improved. Urinations took place every 3 or 4 hours. Four years later patient reported that he had begun to use catheter occasionally, voided every 2 to 3 hours, and had lost considerable weight and strength. Patient was examined at end of 3 years but not since. At that time there was no evidence of recurrence of the cancer.

No. 4726 had complete retention on admission to the hospital and after a course of radium enjoyed 4 years of perfect health, after which he had a recurrence of urinary symptoms. He was first admitted to the hospital on November 18, 1915. His history dated over a period of 1 year. He complained of frequency and hesitancy. Two weeks before entry to hospital he developed complete retention. Rectal examination showed prostate to be moderately enlarged, the median furrow and notch shallow. Pressure in the median line elicited induration and it was impossible to pass the finger between the lateral enlargements as usual. The right lobe was irregular, nodular, very hard, almost stony. The induration was more pronounced toward the apex and toward the lateral portion. The upper end was somewhat soft and elastic, though a little irregular. The right seminal vesicle was slightly irregular, not enlarged, but moderately adherent externally, no nodules, and no marked tenderness. The induration of the prostate did not extend into the membranous urethra. The left seminal vesicle was slightly thickened, drawn outward, a little corded, and moderately indurated. One or two glands were palpable far out along the lateral wall of the pelvis. Between the two seminal vesicles the intervesicular space was soft, no indurated cords or glands. Rectum was negative. Cystoscopic examination showed slight intravesical hypertrophy of the right and left lobes of the prostate. The median portion was elevated in the shape of a bar without sulci on either side. There was no anterior cleft. The trigone was a little hypertrophied but the ureteral orifices were no closer to the prostatic orifice than normal, and the mucous membrane covering the ureteral ridges and trigone was smooth. With finger in rectum and cystoscope in the urethra, the beak was easily felt. The trigone was not thickened but the median portion of the prostate was considerably thicker than normal and quite firm. The patient was given 850 milligram hours per rectum, 785 milligram hours intravesically, and 1000 milligram hours per urethram in 3 months. During this time he had gained 20 pounds in weight. Urinations occurred every 2½ hours during the day and night without any difficulty. Rectal examination revealed a condition simulating chronic prostatitis. The left lobe was slightly irregular. The right was similar to the left. The right seminal vesicle was far less indurated than is often seen in a seminal vesiculitis. The left seminal vesicle was slightly larger than the right but of the same consistence. Six months after the beginning of the treatment, the prostate was found to be slightly broader than normal, but there was no area in the prostate or vesicles characteristic of malignancy.

The patient reported 5 years later stating he had enjoyed the best of health, had not suffered any pain or difficulty in urination except at times when there was a little hesitancy. Recently he had had to get up 3 to 4 times at night to urinate. Rectal examination showed prostate to be quite prominent, moderately enlarged, surface slightly irregular, extremely hard. Induration extended up on each side and involved the lower portion of the

TABLE IX.—SUMMARY OF TABLES III, V, VI, VII, AND VIII SHOWING RELATION OF AMOUNT OF RADIUM TO DEGREE OF IMPROVEMENT

No. of Series	No. of Cases	Average Milligram Hours	Duration	Symptomatic Improvement					Local Improvement				
				Total Percentage	Percentage Degree				Total Percentage	Percentage Degree			
					+++	++	+	0		+++	++	+	0
1	65	1045	4-w	60.0	10.7	18.0	13.3	40.0	23.0	3.0	7.7	12.3	77.0
2	18	2065	4.3-m	66.6	33.3	16.6	16.6	33.3	47.6	11.1	11.1	27.4	52.4
3	10	2503	5.6-m	70.0	30.0	20.0	20.0	30.0	70.0	20.0	30.0	20.0	30.0
4	5	3037	20-m	100.0	80.0	20.0	0	0	100.0	60.0	40.0	0	0
5	2	5628	16-m	100.0	100.0	0	0	0	100.0	50.0	50.0	0	0

NOTE: +++ = complete subsidence of all symptoms or complete resorption of the tumor.
++ = moderate change.
+ = slight change.

TABLE X.—CASES RECEIVING 1 SERIES OF TREATMENTS

Result	No. Cases	Average Milligram Hours
No response	23	625
Symptomatic alone	20	999
Symptomatic and local improvement	22	1415

NOTE: Symptomatic improvement was not complete in many of these cases, nor was there complete resorption of the cancer tissue.

TABLE XI.—EFFECT OF RADIUM ON LONGEVITY

Number of Cases		Average length of life after onset of symptoms
Now dead	48	2.54 years
Not improving	13	3.60 years
Improving	12	4.40 years
Good	5	6.00 years
Unheard from	22	

(Radium treatments were begun in all cases from 1 to 2 years after onset of symptoms.)

seminal vesicles and formed a definite intervesicular plateau. There were no enlarged glands felt and the rectum was perfectly smooth.

This patient received only 2635 milligram hours of radium. Had he received over 4000 in a shorter period, say 8 weeks to 2 months he might have been cured.

No. 5193 was admitted June 14, 1916 complaining of frequency of urination and difficulty in starting the stream. Three years previously he began to urinate every 2 hours day and night. Frequency increased to every hour, associated with dribbling and difficulty in beginning urination. Rectal examination showed prostate and seminal vesicles involved in a definite carcinoma. The prostate itself was only moderately enlarged and a little more prominent than normal. Median furrow and notch were shallow. The right lobe was irregular, considerably indurated, moderately adherent, and fixed. The left lobe was much more prominent and much more indurated and larger than the right, extending well downward toward the perineum and pelvic wall. Outer edge was quite sharp and hard. The right seminal vesicle was about the size of the finger, smooth, very hard, and fixed; induration extended upward and outward in the vesicles which became gradually smaller as far as the finger could reach. The left seminal vesicle was much larger than the right, irregular, nodular, extremely fixed, very hard induration extending outward, and adherent far back, almost to the sacrosciatic notch. No glands were felt in the sacral fossa on either side. The membranous urethra was extremely hard, evidently involved down to the triangular ligament. The bulb of the urethra was not much enlarged, but definitely indurated and apparently involved. The rectum was smooth; the muscularis adherent but the mucosa soft and adherent. X-ray of pelvic bones did not show any demonstrable lesion. In three months 3200 milligram hours of radium were given, 2500 milligram hours per rectum and 700 milligram hours per urethram. At the end of this treatment rectal examination showed the rectum to be a little thickened but not ulcerated. The prostate was about normal size, fairly smooth, and a little firmer than normal. On pressure it seemed distinctly atrophic and thinner than usual. The indurated right seminal vesicle had improved immensely, was still a little firmer than normal and distinctly adherent along the outer edge, but one would not recognize it as being malignant. The left seminal vesicle was drawn outward, slightly indurated, considerably adherent, and possibly one or two small glands were felt far out, but this vesicle would not be recognized at all as malignant. The membranous urethra was a little broader than normal and somewhat indurated and fixed.

Patient's symptoms have improved and remained permanent for the past 4½ years. He voids freely every 3 hours during the day and gets up once at night. He has gained weight and is enjoying the natural mode of life. Recent report by his family physician states that there has been no change in the prostatic tissues for the past 4 years.

This splendid result was obtained with 3200 milligram hours in one series.

No. 5446, 80 years old, was admitted October 12, 1916 complaining of frequent and difficult urination. The urinary symptoms had been present for 2 years. Size and force of stream had become greatly diminished, although he had never had complete retention. At times great

TABLE XII.—EIGHTEEN CASES TREATED RECENTLY (NOT INCLUDED IN THE 100 CASES)

No.	Age	Frequency of Treatment	Radium							Results	
			Urethral	Vesical	Rectal	Interglandular (Needle)	Total	Duration	Irritation	Symptoms	Local
1	69	2-d	600	700	1300	.....	2600	6-w	slight	++	++
2	65	1-d	1000	400	1500	.....	2900	6-w	none	+++	++
3	67	1-d	400	400	1000	.....	1800	4-w	slight	++	+
4	73	1-d	500	400	1800	500	3200	6-w	none	+++	+++
5	78	1-d	800	900	2300	.....	4000	6-w	slight	+++	+++
6	62	1-d	500	400	1000	.....	1900	7-w	none	++	.....
7	63	1-d	800	300	1300	.....	2400	5-w	none	++	+
8	72	1-d	900	.....	2100	500	3500	7-w	none	++	+++
9	80	1-d	500	400	1800	.....	2700	7-w	none	++	++
10	68	1-d	500	400	1900	.....	2800	5-w	none	+++	++
11	71	1-d	1100	800	2100	500	4500	6-w	slight	+++	+++
12	65	1-d	700	500	2700	500	4400	6-w	slight	+++	+++
13	64	1-d	900	500	2300	1000	4700	6-w	slight	+++	+++
14	68	1-d	900	400	2700	500	4500	6-w	slight	+++	+++
15	71	1-d	400	500	2300	1000	4200	6-w	slight	+++	+++
16	66	1-d	1100	900	2000	1000	5000	8-w	slight	+++	+++
17	62	1-d	800	800	2400	1000	5000	7-w	slight	+++	+++
18	69	1-d	500	600	3100	500	4700	7-w	slight	+++	+++

urgency and difficulty in starting the stream were present but he had never had hæmaturia.

Rectal examination showed a prostate which was a little more prominent than normal, slightly enlarged, a little irregular, indurated, and almost of stony hardness. Prostate was moderately fixed; median furrow and notch absent. Both lobes were about equal in size. The right seminal vesicle was corded, moderately indurated and adherent, but no enlarged glands were felt on this side. The left seminal vesicle was about an inch broad, flat, considerably indurated and adherent, and the intervesicular space was partly filled with infiltration. The membranous urethra was obscured by adhesions and low position of the prostate. The rectum was smooth, movable and apparently not invaded.

Cystoscopic examination showed residual urine of 325 cubic centimeters. The bladder was quite irritable and would hold only 200 cubic centimeters. There was no cleft anteriorly and the right lobe was very slightly enlarged. The median lobe was considerably enlarged as a sessile enlargement. The left lateral lobe was not intravesically enlarged. The mucous membrane was everywhere smooth. The bladder was considerably trabeculated. The ureters were readily seen on hypertrophied ridges with pouches in front and behind them.

During the next 2 months the patient received 2000 milligram hours of radium, 500 milligram hours given per urethram and 1500 milligram hours per rectum. Patient then complained of only slight irritation in the rectum. Rectal examination showed prostate not to be enlarged. The median furrow was very narrow and shallow, being almost obliterated. The right lobe was more prominent and apparently extended beyond the mid-line; the surface was smooth and its consistency, although somewhat firmer than normal, was not of stony hardness. "It would, however, even at the present time be regarded with suspicion." The lobe was quite fixed. The left lobe was similar to the right, somewhat less indurated. In the region of the right seminal vesicle the induration described in the right lobe was felt and the vesicle was corded but appeared freely movable. A definite intervesicular plateau could be felt, the upper margin of which appeared to be quite thickened and of the consistency of gristle. The left vesicle except for a slight induration presented nothing of note. The mucous membrane was freely movable except for a slight thickening in the region of the right vesicle. The right seminal vesicle appeared normal. Patient's urinary symptoms were greatly improved. He voided every 2 to 3 hours. Residual urine was only 30 cubic centimeters.

Six months after the beginning of radium treatment he could hold his urine for 5 or 6 hours. Rectal examination showed still less induration and residual urine dropped to 10 cubic centimeters. There was no pain, hesitancy, or difficulty in the act of urination. (No treatment was given at this time. This was a grievous mistake.) Two months later rectal examination did not show any evidence of carcinoma and the picture was one of a slight grade of prostatitis and seminal vesiculitis. Fourteen months after admission the rectal examination remained the same as at 8 months, but the residual urine had increased to 75 cubic centimeters. Patient then apparently remained perfectly well for 3½ years when he began to have urinary difficulty and complete obstruction soon followed. Rectal examination at this time showed prostatic hypertrophy of slight degree. It was everywhere soft and elastic. The right seminal vesicle was not enlarged nor hard. The left was somewhat adherent but compressible. There was moderate œdema of the rectal mucosa. There was nothing to indicate recurrence of the cancer. Cystoscopic examination, however, showed a necrotic mass on the left side of the bladder which involved a portion of the vesical orifice. Whether this was an ulcer due to radium given 4 years previously or whether it was cancer was not determined. X-ray did not show any involvement of the bony pelvis.

Since the patient had obstruction to urination which was due to contracture of the neck of the bladder and to the infiltration of possible cancer growth, it was decided to give him more radium. Sixteen hundred milligram hours were given per rectum, 500 milligram hours per urethram, and 400 milligram hours intervesically. In one month patient began to void every 3 to 4 hours and residual urine ranged from 10 to 110 cubic centimeters. He had very

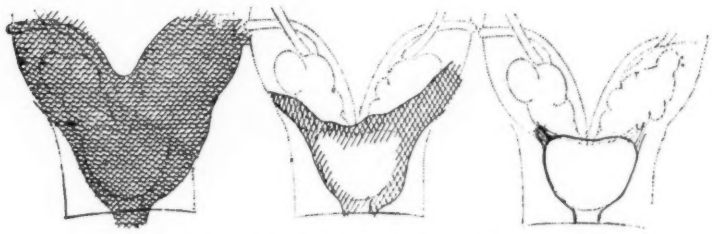

Fig. 1. Case 12. Chart showing involvement on admission, April 27, 1921; after treatment consisting of 1500 milligram hours, May 24, 1921; and after 4400 milligram hours, June 21, 1921.

little rectal irritation. He would leave the ward to go to an afternoon matinee and return without any urinary discomfort. Last rectal examination showed no enlargement of the prostate. The seminal vesicles were soft and elastic. There was no evidence of carcinoma. Cystoscopic examination showed ulceration of left side of bladder. Prostatic orifice showed considerable œdema. Left lateral margin was negative. Just behind it was a small necrotic mass. With finger in rectum and cystoscope in urethra, trigone did not seem to be thickened, as it is in cases which have definite carcinoma of the prostate. There was no infiltration of the suburethral tissues. Died, at home, of pneumonia 1 month later. Necropsy not permitted.

No. 5759, 75 years of age, was admitted in March, 1917. The history dates over a period of 2 years. Nycturia was the first symptom. Frequency of urination gradually increased both night and day so that he had to void every hour. Size and force of the stream had diminished so that there was considerable dribbling. He had never noticed any hæmaturia.

Rectal examination showed that the prostate was quite irregular on the surface. In the left lobe toward the periphery there was a sharp edge, rather precipitous which was characteristic of neoplasm. In the mid-line it was soft. The prostate extended up rather far in the mid-line between the seminal vesicles almost as far as the finger could reach. The seminal vesicle did not seem to be particularly indurated. The membranous urethra was soft, as was also the apex of the prostate. The growth seemed to lie between the seminal vesicles involving the posterior portion of the prostate.

Cystoscopy. The instrument was readily introduced and found 50 cubic centimeters residual urine. The bladder showed evidence of obstruction. The walls were trabeculated and there were a number of cellules. The prostatic orifice showed no clefts, some irregularity, and some œdema, but no intravesical lobes. The trigone was visible. With finger in rectum and cystoscope in urethra it was possible to make out marked thickening in the base of the prostate as the shape of the instrument could not be felt. There was present a marked indurated mass between the instrument and the finger.

The patient received three series of radium treatments during the next 6 months. The first series was given from March 16 to April 4—700 milligram hours per rectum and 200 milligram hours per urethram. On April 6 patient was voiding every 5 or 6 hours during the day and getting up once at night. He was also passing small amount of mucus per rectum. Rectal examination showed both lobes of the prostate less resistant than at first examination. Along the border of the right lobe near the base was still quite marked induration. This was true also of the left side.

On May 23 patient returned for second series of treatments. Rectal examination showed prostate considerably larger than normal, somewhat irregular, definitely softer than before the radium treatment. The left lobe was only slightly larger than normal. There was a hard area in the periphery of the right lobe and some induration at the base of the right seminal vesicle. There was no thickening of the rectum. The patient then received 600 milligram hours of radium, 500 milligram hours of which were given per rectum and 100 per urethram.

Patient received third series of radium treatments in September of that year at which time he was given 10 hours of radium of 100 milligrams each,—800 per rectum and 200 per urethram. Patient showed moderate rectal irritation, which lasted for 4 weeks only. Urinations remained normal. Rectal examination in November showed very little change in the rectal mucosa and no ulceration. The prostate was a little larger than normal, irregular, compressible, and adherent.

Two years later the patient was again examined. Symptomatically he had been free from frequency and pain. Residual urine was 15 cubic centimeters. There was a slight stricture of the urethra which was easily dilated. Rectal examination showed the prostate broader than normal and the vesicles broad and adherent; but neither the prostate nor the vesicles were very markedly adherent. The surface was fairly smooth and flat. It would have been impossible to make a diagnosis of carcinoma at this time.

Patient returned in July, 1920, stating that he had been in excellent health but during the past 6 weeks had noticed a little frequency of urination. At times he would void every 10 minutes, but could hold urine for 5 or 6 hours. He slept well and was doing his usual work. Prostate was a little broader than normal, moderately indurated, and slightly adherent. Above the prostate was a plateau which extended across the pelvic cavity, more prominent on the left side. In the mid-line there was a small area simulating an excoriated area. The patient was given 1100 milligram hours of radium per rectum over the seminal vesical regions with the result that there was resorption of the indurated areas.

Patient has not been examined for 1 year but he recently reports that his general health is excellent, he has maintained his weight, and is doing his usual work. He is voiding every 6 hours without difficulty. There is no pain in the back of thighs. He writes: "I have no symptoms that can be referred directly to the prostate and bladder."

This is a case which apparently could not endure the concentrated form of treatment. The

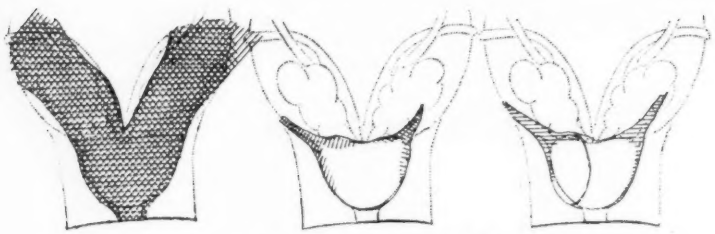

Fig. 2. Case 15. Chart showing involvement on admission, April 21, 1921; after 2700 milligram hours, June 6, 1921; and after 4200 milligram hours, June 15, 1921.

patient received 3100 milligram hours in four series. The result has thus far been most encouraging.

TWENTY-THREE CASES WITH NO RELIEF OF SYMPTOMS

In contrast with symptomatic, local, and good results, a certain number of cases failed to respond to radium treatment. Many of these received small doses, too small to produce any definite action on the carcinoma, while others received 1200 to 1400 milligram hours and should have shown at least a change in symptomatic condition. Such was not the case. None of these cases showed any ill effect from the radium, and there was no reason why treatment should not have been continued as far as the charts indicate, except that in a few instances patients left the hospital of their own accord. Twenty-three cases did not react to radium. A further study of these cases showed that the average amount of radium given was only 625 milligram hours, while the average for those receiving at least some improvement was 1415 milligram hours.

There was only one case which showed local results without symptomatic. This case proved to be one with well-developed growth along the urethra. He had received 1400 milligram hours of radium, all given per rectum. Had he been given extensive treatment to the urethra and internal vesical orifice, symptomatic results would almost undoubtedly have been obtained. In no case did we find that radium stimulated the growth of the cancer. It is, therefore, quite clear that those who did not show any relief of symptoms did not receive radium enough, while the next grade obtained a symptomatic improvement, and when still more radium was given, local results were obtained.

IRRITATION FROM RADIUM

The irritation from radium rays has been one factor for consideration in this therapy. It was not until after this analysis had been completed that we were able to combat the main objection to radium treatment. Twenty-eight cases showed more or less local discomfort. Some were very slight, while others were severe. However, all are included in this series so as to definitely determine the factors involved. There were no general systemic reactions such as nausea, vomiting, chills, fever, etc. All symptoms of irritation were localized and manifested by rectal and urethral burning, urgency for stool, passage of mucus, and occasionally blood per rectum, and in two cases ulceration of the rectal mucosa.

Rectal. Irritation of the rectum in the form of an aching, smarting, and burning sensation was noted in all of the 28 cases. In 9 cases it was very slight and hardly worth mentioning; it lasted for a few days and caused no change in the patient's daily routine of affairs. In other cases the irritation became intolerable. Especially was this noted on evacuation of the bowels or when fæcal matter reached the rectal area treated. The patient would then ask for an enema or opium suppository, or both. The rectal irritation began at about the tenth treatment and often lasted for 2 or 3 weeks after the series had ended. The more severe cases would complain of some pain as long as 6 months afterward.

Mucus. The passage of mucus per rectum was noted in 19 of the 28 cases. Mucus did not appear until several days after the patient complained of burning and smarting, or during the latter part of the series. Usually it was an indication to dispense with the treatment. Some cases were treated until they could not tolerate the applicator in the rectum. Those cases receiving large doses at one sitting or frequent treatments in the same area were first to show evidence of irritation. In some of the severer cases frequent bowel movements accompanied with mucus or evacuations of mucus alone were demonstrable. Never were there over eight to ten movements in 24 hours in the most severe cases, but there was

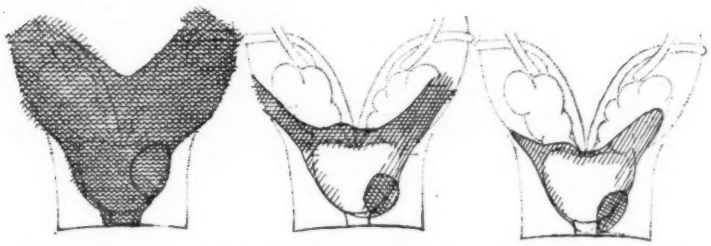

Fig. 3. Case 18. Chart showing involvement May 10, 1921; after 3200 milligram hours' treatment, June 7, 1921; and after 4700 milligram hours, June 22, 1921.

moderate tenesmus and straining at stool. In none of the cases was it permanent; in most cases it subsided after 3 weeks, but in two cases it persisted for 8 months. Urgency for stool was present in 6 of the cases discharging mucus Blood-streaked mucus was noted in 4 cases only.

Urethral. Smarting and burning sensations were the main complaints in this region, although complete retention occurred in 3 of the cases, 2 to 5 days following the first treatments. After 2 or 3 days of complete retention they began to void and in about one week the size and force of the stream gradually returned to much better quality. Five of the cases complained of urethral irritation. These symptoms were never so prominent as the rectal distress nor were they as prolonged.

Ulceration. Only two cases developed ulceration of the rectal mucosa. One healed entirely in 10 months and the other developed a recto-urethral fistula 4 months after the treatment (recently 2 other cases of rectal ulceration have appeared). The latter case showed on admission a hard nodule in the center of the prostate with little involvement of the lower portions of the seminal vesicles. He received 2800 milligram hours of radium, 200 of which were given in the rectum over or near the nodule. The result was complete resorption of the mass and the development of ulceration. The patient complained of considerable burning and tenesmus for 6 months. He, however, suffered very little from the small fistula. He makes a statement 6 years afterward that he is doing as much work as ever and feels perfectly well, except that he has in 24 hours three to four bowel movements, a good part of which is composed of urine. No fæcal material has ever passed the urethra. His urinations are not oftener than normal and he does not have to get up at night. He is apparently cured of the cancer, although he had never returned for further examination. These two cases occurred early in the use of radium. None of the last 150 cases have developed ulcerations. It is certain that they can be avoided and must be kept in mind when giving a large series of rectal treatments. Large urethral treatments will give rectal irritation as well as rectal treatments, and occasionally rectal treatments may cause a diminution in the size and force of the stream with exaggerated hesitancy, but this lasts only for a few days at most. If 150 to 200 milligram hours are given at one sitting in one place there is considerable smarting and burning in that area in 4 days which lasts for 3 weeks. Generally it may be stated that treatments exceeding 150 milligram hours in one place at one sitting or the same area treated oftener than once a week to 10 days will produce an irritation.

With the intensive treatment now used, no ulcerations have developed and the patient is able to tolerate 4000 milligram hours better than 2000 milligram hours given by the former method (2 recent cases may require us to modify this statement, H. H. Y.). Frequently a patient passes mucus and has from two to four stools a day with some discomfort or tenesmus, but these symptoms finally disappear. None have complained of constipation. Needles introduced directly into the cancer through the perineum for a 500-milligram-hour treatment have not caused any irritation or discomfort of any sort.

There have been no general systemic reactions with malaise, nausea, vomiting, or elevation of temperature. As a rule, the patients feel better and are able to tolerate a larger number of treatments if they are allowed the freedom of out-of-doors, and are treated as ambulatory patients rather than if we house them in their rooms for 4 or 5 weeks. Hygienics play an important rôle in the treatment of malignant disease as well as in other diseases and should be kept in mind in the treatment of cancer of the prostate with radium.

MORTALITY

The expectancy of life of a patient with cancer of the prostate is a variable factor. As a rule, prostatic cancer is a slowly developing malignancy. In estimating the length of life of a patient from the beginning of the symptoms it is almost impossible to be accurate, for many have an extensive invasion of cancer before any urinary symptoms appear. It seems, however, to be the only method which we have at our present command. The average length of life after beginning of symptoms for the 48 cases known to be dead is 2.54 years. Twenty-two patients were not heard from. They failed to answer the second questionnaire, and a third sent to the family physician failed to elicit further details regarding them. The statistics show 13 cases who are not improving and have now lived an average of 3.6 years since onset of symptoms. Many of these have improved symptomatically, and locally there has been a softening of the prostatic tissues, but there is a general decline in health due to metastases. There are 12 patients still under treatment who are showing improvement. The average length of life in this group is 4.4 years.

Those cases which are considered as good results have now lived an average of 6 years since onset of symptoms. There are 5 cases in this group. Table XI shows that, even where cure is impossible, treatment with radium tends to prolong life and that in a certain number of cases a cure may be expected.

We have no definite histological proof that radium is a cure for inoperable cancer of the prostate, but we may draw valuable conclusions regarding its effect and in this way guide our methods of application of the γ rays in such a way that in the future it may yield a much higher percentage of good results. There is no doubt that radium is as good a therapy as any that we have at our command; that patients may be relieved of much pain and discomfort in their last years, even if a cure cannot be instituted in a majority of the cases. Relief of symptoms is what the patient comes to us for just as he does in any other disease, and why should we not give him relief or even the benefit of medical science, if a cure cannot be obtained? Because a case is incurable is no reason why our profession should turn him over to the land of opiates. He should at least be given the benefit of radium therapy even if only symptomatic results can be obtained.

Table XII shows the result in 18 cases receiving at the first series the more concentrated form of treatment. The results obtained are too recent to pronounce cures and sufficient time has not yet elapsed to allow the radium to produce its total effects symptomatically and locally; but all cases except one show on discharge a very remarkable change in both consistency and size of the carcinoma. The detailed rectal findings together with the prostatic charts of three of the cases are given. These are not exceptional cases, but are cases in which, when there are no bone metastases, the results are more uniform than heretofore obtained.

CASE 12 (Table XII). April 27, 1921, rectal examination shows few external hæmorrhoids, with anal sphincter of good tone. Prostate is markedly enlarged and projects into the rectum. Median furrow and notch are just made out. The right lobe is markedly indurated, slightly irregular and markedly adherent externally. Left lobe is also markedly indurated and adherent externally, but is not so markedly indurated as the right lobe. Induration in both lobes, especially on the right, is of stony hardness. The process on the right side extends up into the vesicle, which can be felt markedly indurated. Few enlarged glands on the inner surface. The process on the left side extends up to a certain extent to the seminal vesicle, which is also greatly indurated.

May 7, 1921, patient has been treated here with radium by rectum and urethra, receiving 15 treatments, one hour each, with 100 milligrams of radium. He stood this treatment well. Until this morning he had very little difficulty in urinating but micturition was very difficult this morning. Patient got up 3 or 4 times last night, being able to void only small amounts. He was catheterized this morning and 750 cubic centimeters residual urine found. He is going home for 2 weeks and is instructed to be catheterized 2 or 3 times daily, if necessary.

May 24, 1921, rectal examination shows prostate enlarged moderately, the right being much larger than the left. The left lobe is only slightly larger than normal, smooth, slightly indurated, elastic, only slightly adherent. The upper end is slightly indurated, the induration extending upward and outward along the outer side of the left seminal vesicle, which is now soft. This induration is only of slight degree. The right lobe of the prostate is moderately enlarged, slightly irregular, slightly indurated, considerably adherent along the outer edge and near the apex, at which point it is much more indurated than elsewhere and very adherent. (Seems evident that not enough treatment has been given at this point.) At the upper end of the prostate, there is a line of irregular infiltration, of considerable degree, which extends upward and outward along the pelvis, as far as the finger can reach. Slightly enlarged glands are palpable here. The seminal vesicles are distinctly palpable, probably invaded. Between the vesicles there is slight induration. (See Fig. 1.) The membranous urethra is broader than normal, moderately indurated. Patient then received 2900 milligram hours.

June 21, 1921, patient returns for observation for the third time. He has had no treatment for 2 weeks. Patient stated that he has had a good deal of discharge from "bowels," at times is constipated, and at other times has marked frequency of stools if he takes a purgative. There is no pain or discomfort in the rectum, except during stool. He passes a good deal of mucus, but this condition is improving. Vesical condition is very greatly improved. He voids urine at normal intervals, without difficulty or

Fig. 4. Scirrhus cancer of the prostate.

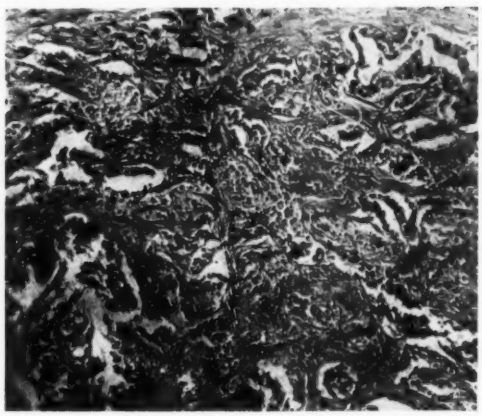

Fig. 5. Adenocarcinoma of the prostate.

pain. There is no pain in back, hip, or thighs. General condition has been fairly good. He simply returns for observation.

The anal sphincter is in good condition. Prostate is now a little broader than normal especially on the right side. Left lobe is about normal size and consistence and is not adherent. Left seminal vesicles are apparently not indurated and only slightly adherent along the outer edge. The right lobe is little broader than normal, slightly indurated and slightly adherent. There are a few adhesions running up along the wall on each side. The condition does not even now suggest carcinoma. Between the vesicles the tissues are quite soft. Examination causes slight bleeding from the rectum.

Case 15 (Table XII). April 21, 1921, rectal examination shows sphincter of good tone, with no external hæmorrhoids. The prostate is moderately enlarged, projects into the rectum, median furrow and notch obscured. The right lateral lobe is smooth, elastic, moderately indurated. The left lobe is more prominent than the right, smooth, elastic, moderately indurated and somewhat adherent. The seminal vesicles are drawn out and adherent laterally with some induration at their bases. There is no intervesicular plateau of induration. The base of the bladder feels soft. On the left side a small hard body is felt, probably a phlebolith.

Cystoscopy. Prostatic orifice shows no cleft anteriorly. There is a markedly elevated median portion. With finger in rectum and cystoscope in urethra, the trigone is not thickened. Median portion of prostate is much thicker and longer than normal and quite firm, somewhat nodular. The left lateral lobe is nodular and indurated but still somewhat compressible, the right lateral lobe the same. The whole prostate forms a transverse mass around the shaft of the instrument and the induration and enlargement beneath the urethra extends to the apex, in other words there is a suburethral thickening which extends practically to the apex of the prostate and which itself suggests malignancy. Induration, however, is not of stony hardness.

June 6, 1921. Patient has now had 18 treatments per rectum, 4 per urethram, and 5 by bladder, a total of 27 treatments. During the past month his general condition has improved remarkably, he has gained 5½ pounds in weight, appetite has improved, and patient feels very much stronger. Patient voids about every 3 hours, moderate-sized stream with natural act of micturition, force of stream not quite normal. No headache, backache, or pain in the thighs. Patient has had some rectal irritation, passes a small amount of mucus but never any blood. Patient has had some frequency of bowel movement, about 7 or 8 a day, but the rectal condition has now improved so that the bowels move only once or twice a day. Patient considers himself remarkably improved.

Rectal examination, June 15, shows a prostate that is now normal in size and consistence, not nodular, not indurated except slightly, not adherent. The change is really remarkable. Right seminal vesicle now feels only slightly indurated along the outer edge, no enlarged glands or adhesions are felt. Left seminal vesicle is also small and soft, not indurated or adherent. Rectal wall is somewhat swollen and redundant but does not feel ulcerated.

From examination at present one would never suspect that this patient had carcinoma of the prostate and seminal vesicles.

Case 18 (Table XII). May 10, 1921. Rectal examination shows anal sphincter good, somewhat spasmatic. Prostate is very irregular. Left lateral lobe is somewhat nodular, extremely indurated, fixed, induration almost of stony hardness and extending down along the membranous urethra but not palpable in the bulb, external to the triangular ligament. Right lobe of the prostate is also irregular, markedly indurated, extremely prominent as you go backward and the induration extends forward to the left lateral wall of the pelvis and obscures the seminal vesicles. This indurated mass makes it impossible to feel the left seminal vesicle. At the upper end, on both sides, there is a transverse plateau of marked irregular induration, which extends from one side of the pelvic wall to the other, upward, as far as the finger can reach and beyond. Rectum also is everywhere smooth, and on the left side it is freely movable upon the prostate and seminal vesicle. On the right side the musculature is invaded and rectum is fixed.

June 8, 1921. Patient has had about 32 treatments. He complains only when he goes to stool, desire for which

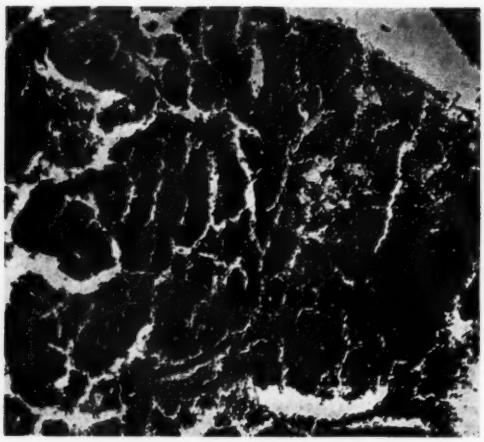

Fig. 6. Cellular or medullary cancer of the prostate.

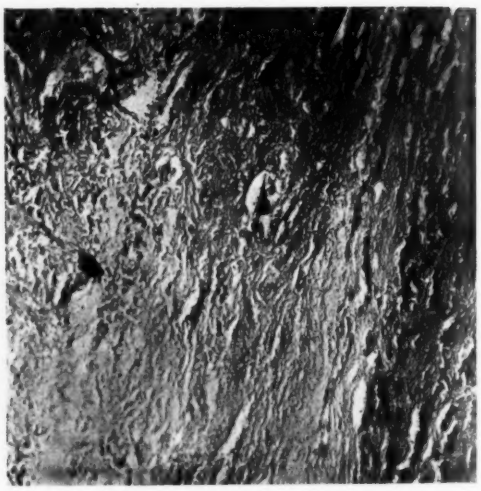

Fig. 7. Adenocarcinoma showing complete destruction of the cancer with marked fibrosis following radium treatment.

is very frequent. He is not required to get up at night for stool. He has not passed any blood but has passed a good deal of mucus. Gets up once or twice at night to void, voiding freely, good stream, without much pain. Patient has had only four treatments per urethram and none with needles through the perineum. Treatment over the seminal vesicles and along the pelvic wall are also apparently incomplete.

Rectal examination, June 22, shows anal sphincter in good condition. Rectal wall is everywhere smooth, it is not particularly tender and no areas of ulceration or excoriation are felt. Left lobe of the prostate is now about normal in size, only slightly indurated. Little nodule present at the upper end, where the induration runs upward and outward along the lateral wall of the pelvis, as far as the finger can reach. The induration in this region is only moderate in degree, likewise between the two vesicles as shown in diagram. The point in which there has been less treatment is on the right side along the outer edge and at the apex.

The cure of cancer of the prostate and seminal vesicles has thus far been a difficult problem. Surgery has failed except in a very few selected cases where the cancer is small and limited to the prostatic tissue. We attribute the failure to (1) the inaccessibility of the tumor, (2) the late appearance of the case in the clinic, (3) cases with bony metastases, (4) improper technique and (5) insufficient radiation. These difficulties are rare in surface cancer. Since the action of radium varies inversely to the square of the distance, it is, therefore, necessary to apply the γ-rays as near as possible to the tumor to obtain the maximum effect. With this basic principle in mind and avoiding the severer irritations, we should be able to control cancer of the prostate in those cases which have not developed metastases beyond the seminal vesicles.

Large doses of radium in the shortest possible time applied to all surfaces of the prostate, viz., per rectum, per urethram, and per vesicam, apparently control the peripheral growth. Cases which have shown recurrence have done so in the mid-prostatic and vesical orifice and seminal vesical areas. More careful technique has controlled all the areas except the mid-prostatic portion.

Intraglandular radiation with needles adds much to supplement the surface treatments. Either treatment without the other is inadequate. If needles alone be used then the tips of the seminal vesicles escape radiation. Cases should be examined every 3 months to detect any area of recurrence so that further radiation may not be delayed. If rigid technique with massive doses be used, we believe that cure of cancer of the prostate, provided there are no metastases beyond the seminal vesicles, lies within the scope of radium treatment.

CONCLUSIONS

1. Radium gave symptomatic relief and return of normal urination in 75 per cent of the cases.
2. Radium relieved the pain in the back in 50 per cent of cases suffering from metastases.
3. Irritation from radium can be avoided by treating widely remote areas in successive treatments and by alternating between rectal, urethral, and vesical applications.

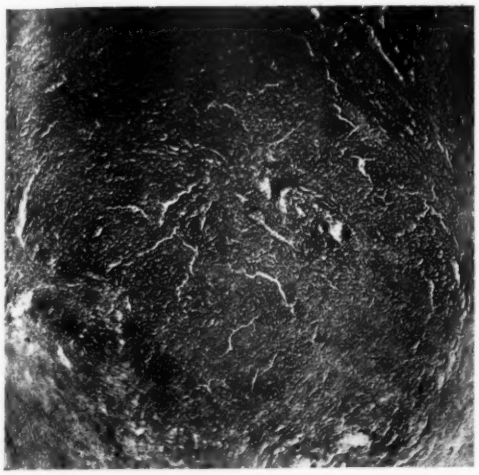

Fig. 8. Adenocarcinoma showing necrosis due to radium applied intraglandularly.

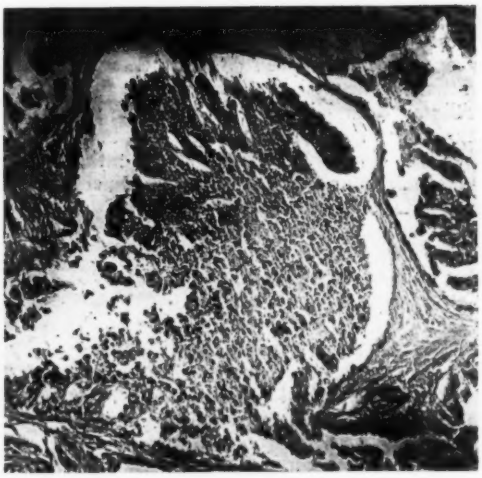

Fig. 9. Adenocarcinoma showing variable effect of radium. One-half of the alveolus shows degenerative changes while the other half shows healthy cancer tissue. —3 weeks after termination of radium series.

4. At least 1000 milligram hours must be given to produce any symptomatic improvement.

5. Fourteen hundred milligram hours must be given to produce any perceptible change in the tumor mass.

6. Three thousand milligram hours must be given to produce symptomatic and local results in the same patient.

7. Four thousand and 5000 milligram hours in a period of 6 to 8 weeks should be given if possible, in addition to needle treatments of 500 to 2000 milligram hours through the perineum.

8. Cases which did not respond to radium did not receive sufficient radiation.

9. Large doses must be given in as short a period as possible to produce maximum results.

10. No general systemic reactions have been encountered.

11. Combined extraglandular and intraglandular radiations apparently give the most satisfactory results.

12. Thus far we have no actual proof that radium has produced an actual cure for cancer of the prostate and seminal vesicles, although three cases remained free from symptoms and tumor growth for more than 4 years and many others show on rectal examination a condition of the prostate which does not now resemble cancer.

II. Results of Radium and Operation in Cancer of the Prostate (33 cases)

Radium and surgical methods have been used to give relief in some of the more difficult cases of cancer of the prostate and seminal vesicles. Herein lies a possibility which must not be overlooked as better results may be obtained in a certain number of cases by a combination of radium and surgery. Questions naturally arise: Can we remove the cancerous tissue after it has been treated with radium and increase the opportunities for cure? Can we remove most of the malignancy and treat the remainder with radium? Do we spread the cancer by operative measures? Can we obtain better results by preoperative and postoperative application of the radium, or can we at the time of operation remove as much of the cancer as possible and then apply massive dose treatments?

The operative series is a small one consisting of 33 cases. Practically all the possibilities previously mentioned have been carried out. It is certain that operative measures do not add to the risk of metastatic development. A series of 100 cases which were operated on without radium treatment lived almost as long as cases which were not operated on and which received radium treatment alone but there was no attempt to cure these cases.

This series of cases is similar to the series of 100 cases previously treated with radium alone. Ages range from 58 to 80, the largest number of cases being found in the seventh decade. There were three cases under the sixtieth year, twelve between 60 and 70 and six between 70 and 80.

The prostate was generally invaded in all the cases. Both seminal vesicles were involved in all except three and these showed an extensive infiltration in one vesicle. The average number of milligram hours given before operation was 1380, ranging from 400 to 4000. Treatments extended over a period of 1 week to 14 months. The symptomatic and functional improvements were not marked, being only 26 per cent. None of the patients were entirely relieved from all their symptoms. Thirty-eight and eight-tenths per cent showed local improvement, but not complete resorption of the cancer.

The operations performed were of two types: (1) conservative perineal prostatectomy—by means of which the cancerous tissue about the prostatic urethra and vesical orifice was removed: (2) subtotal prostatectomy—by means of which the capsule of the prostate was removed together with the cancer. There were two operative series: one which received pre-operative radium treatment and another which received post-operative radium treatment.

There were 28 cases which received radium before operation. These were treated per urethram and per rectum: 7 cases received rectal treatments alone and 20 received rectal and urethral treatments. The total radiation varied from 400 to 4000 milligram hours, the average radiation being 1600 milligram hours. Most of the cases were operated on at the end of the series of radium treatment by the conservative method. Nine cases received massive doses of radium at the time of operation. A 100 milligram capsule was inserted at the time of operation into the wound and allowed to remain from 5 to 8 hours. No untoward results have occurred and there has been no interference with the closure of the wound, in fact they have healed as rapidly as the benign hypertrophy cases. No fistulæ have developed.

Postoperative radium treatment. Five cases were operated on first and then given radium. Two received 1600 milligram hours at time of operation; the other three were given 100 milligram hours' treatment after the wound had healed. These cases, like the others, left the hospital voiding normally.

RESULTS

The time elapsed since treatment has not exceeded 4 years, so it is quite possible that some may develop a recurrence. Four cases have now lived 3 years and are apparently entirely relieved of symptoms and local tumor. Statistics show that 12.1 per cent of the cases have an excellent result—classified as "good result"; 66.6 per cent were improved; and 21.2 per cent remained unimproved. The cases showing good results have a complete subsidence of all urinary symptoms and no further development of local tumor. Those cases improved show relief of symptoms but rectal examination discloses active cancer present. The 21.2 per cent unimproved did not get relief by operative measures. There was still urinary difficulty with palpable cancer in prostatic tissue. Of the 33 cases 51.5 per cent have died. Death was due to metastases in all cases. These cases lived from 5 to 22 months—an average of 11 months after operation. Those cases in which good results were obtained received a combination of radium before and after operation. The amount of radium before operation did not exceed 2000 milligram hours in 2 of the cases. Two received 2500 and 3100 milligram hours. The operations were the conservative type. The amount of radium given after operation ranged from 1200 to 2100 milligram hours, giving a total radiation of 3000 to 4000 milligram hours. These cases have not been examined for 1 year, but they report that their urinations are normal. Last rectal examination, 2 years after operation, did not show any return of cancer.

There are two cases recently treated with large pre-operative doses of radium. Each received 4000 milligram hours. Two weeks later a perineal prostatectomy was done. Both specimens removed at operation showed hypertrophied tissue invaded by cancer. The capsule stripped readily and was free from cancer. Apparently complete resorption of the cancer had taken place in the capsule. It is fair to believe that control of the growth has been accomplished in these cases and that by removing the adenoma a cure has been obtained. Those cases receiving only postoperative radium apparently did not receive sufficient radiation as they occur in the improved group.

HISTOLOGICAL PICTURE

Study of the specimens removed at operation is the only method of deducing accurate conclusions regarding the effect of radium. The histological picture is by no means uniform. The sections from some of the specimens removed after application of 800 milligram hours of radium show considerable change in the periphery, while others taken from specimens which had received 2000 milligram hours failed to show any effect of radium whatsoever. None of the specimens showed complete destruction of all the cancer tissue, although there were areas in which destruction was complete. Just why there was such

irregularity in the histological findings we do not know, but there are several possibilities which must be considered, viz., kind of cancer, the frequency and method of treatment, and the specific or selective action of radium for certain cells.

The action of radium has been found to be of two kinds: (1) a gradual disappearance of the cancer tissue and the development of fibrous tissue and (2) necrosis.

The gradual changes produced by radium have been well described by Drs. Young and Frontz (2) and Dr. Alter (3). The effect of radium does not correspond in all cases to the amount of radium given. Some tissues show marked changes while others show little change that can be ascribed to radium. The periphery of the specimens naturally shows the first evidence of radiation. Different conditions of degeneration can be easily seen in many of the specimens, such as pyknosis of the nuclei, vacuolization, shrinking of the cytoplasm, and in some cells a few poorly stained granules. Other cells show granules taking very deep stain. Increase in fibrous tissue is a prominent factor in most of the sections. It is firm, the strands are packed tightly together and form a dense, hard tissue. Between some of the layers of fibrous tissue small darkly stained granules or outlines of a few cancer cells may be seen, indicating complete destruction of the cancer with development of fibrous tissue.

In all the cases treated with extraglandular methods no necrosis of tissue was found. Whenever a change occurred it was a picture of gradual melting away of the cancer tissue and a development of fibrous tissue. One specimen had been treated intraglandularly with two needles. Each needle contained 12.5 milligrams of radium and was allowed to remain in position for 24 hours. The operation occurred 2 weeks later. Sections from this specimen showed necrosis of all the tissue within a radius of 4 millimeters. The connective tissue stroma as well as the cancer forms a necrotic area (see figure 5). No such areas have been seen in the other specimens although some received 4000 milligram hours.

We have considered the fact that different kinds of cancer might react differently to radium and cause a diversified histological picture. There are three kinds of cancer of the prostate thus far recognized: (1) the scirrhus with small cell nests and large amount of fibrous tissue, (2) the adenocarcinoma, and (3) the cellular or medullary.

The scirrhus is not an uncommon type and is composed of dense fibrous tissue in which are small irregular nests of cancer cells, each nest containing from 5 to 10 cells. The cytoplasm stains heavily. Mitoses are rare. One gains the impression of very slow-growing, infiltrating type of cancer. Of the five cases showing scirrhus cancer only one shows changes accredited to radium and this change is found only in the periphery. The other four cases do not show any evidence of the effect of radium although two received over 2000 milligram hours of radium.

The adenocarcinomata comprise the largest proportion of specimens. The effect of radium on this type is variable. It is apparently resistant to relatively strong doses of radium, as some of the specimens had large amounts of radiation with little effect while others showed an effect which corresponded to the amount of radium given. No. 4718 is a case which received 2000 milligram hours in the same area in 9 months. Section through that area shows typical active cancer with moderate connective-tissue stroma. No. 9038 shows after 4000 milligram hours of radium given in 6 weeks a benign adenoma invaded with cancer. The prostate was removed *in toto* and sections were cut at different levels. Large areas containing solid masses of degenerated cancer cells were seen throughout the section. Here and there were a few masses of cancer cells which appeared perfectly normal in shape and outline. There was no swelling, vacuolization, or granular condition of the cytoplasm. Mitoses were rare. Why these areas remain unaffected when adjacent cancer tissue on all sides shows degenerative changes is an unsettled question. The connective tissue was rather marked in amount, but the benign adenoma was not affected. Twenty-seven of the 33 cases were of the adenocarcinoma type; 7 showed generalized carcinomatous degeneration in various stages. The amount of radium varied from 900 milligram hours to 4000 milligram hours. Of the 20 remaining cases only 8 showed changes in the periphery; while 12 did not show any evidence of degenerative effect from the γ-rays, although these received from 900 to 3000 milligram hours.

The third type or cellular cancer of the prostate is in gross a very soft mucoid, chocolate-colored material. Microscopically it is found to be made up almost wholly of cancer cells interspersed here and there with collections of red blood cells. There is a very small amount of connective-tissue stroma. One case was found among the 33 cases. Fourteen hundred milligram hours of radium were given—but no change due to radium could be discerned from the study of the sections.

CONCLUSIONS

1. A combination of radium and surgery offers a possibility for treatment of cancer of the prostate and seminal vesicles.

2. Operation does not diminish the amount of radium necessary to produce good results.

3. Operation does not increase the possibility of hastening metastases.

4. Histological picture is variable.

5. Radium does not act alike on all cancer tissue.

6. Radium has two distinct actions: one of gradual cell destruction and fibrous displacement and another of necrosis.

7. There are three kinds of cancer of the prostate: (1) scirrhus, (2) adenocarcinoma, (3) cellular or medullary.

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SHORT CIRCUIT OF THE VAS DEFERENS

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IN the year 1902 Martin (1) of Philadelphia, in collaboration with several others gave out the results of a series of experiments which they had performed upon dogs, with a view to perfecting the technique of an operation designed for the relief of sterility resulting from obliterating bilateral epididymitis following gonorrhœa. These investigators felt that the success of their experiments justified them in performing the operation upon a human subject in cases in which a childless marriage was the result of azoospermia, consequent upon a double obliterating epididymitis.

Acting upon this belief, Martin performed the operation upon an apparently healthy young man, anxious for children, whose wife had been previously subjected to dilatation and curettement before it had occurred to any of those interested that the fault might possibly lie with the husband. Under ether, the vas at the left side was freed about the level of the top (of the) testis, its lumen opened, and the epididymis exposed for its entire length. The vas was then implanted in an incision in the epididymis by means of four fine silver wire sutures; a suture was placed at either end of the vas incision, and the vas itself held open by a suture on either side. Motile spermatozoa were demonstrated in the semen 19 days after the operation.

Martin remarks that the approach to the epididymis is not difficult, nor does it seriously endanger the nutrition of the testes by interfering with their blood supply. The vas lies behind the spermatic artery, which sends its main branches forward to the inner side of the epididymis, anastomosing freely at this point with the artery of the vas. The portion of the vas which is used for the anastomosis must be carefully dissected free from its surrounding vessels and nerves, and carried to the outer side of the vascular plexus of the cord until it can be readily applied to the exposed surfaces of the epididymis. Because of the smallness of the structures involved the operation is tedious rather than difficult.

About the time of Martin's operation, Scaduto (2) carried on extensive experiments upon dogs, but did not prove his conclusions by operating upon a human subject. Posner (3) in Germany also was successful with animals, but his six operations upon man were all failures. The meagerness of the literature for a number of years afterward gives evidence that very little attention was being paid to the possibilities of this particular line of work, and Quinby (4) writing 6 years after Martin, found no other recorded instance of its successful performance upon man. Quinby himself experimented with guinea pigs, and concluded that from his results, added to those obtained by Martin and the others, there was no doubt that vaso-epididymal suture with proper technique is a perfectly definite surgical possibility. Applied to the human being after the diagnosis of permanent azoospermia due to obliterating epididymitis has been established, there are three considerations which favor the employment of such surgical intervention. First, the condition after operation cannot be worse than it was before; second, since the restoration of patency on one side alone is sufficient to permit ability to impregnate, this offers the patient a double chance of cure; third, the operation, offering as it does the only rational means of relief from such a condition of sterility, has been proved feasible in both animals and man.

In the performance of the operation it is necessary to consider carefully the seat of the stenosis in relation to the anatomy of the parts, and in each instance make the union at a place which will as surely as possible create an efficient short circuit. The determination of such a spot on the epididymis can best be made by the hypodermatic syringe. Withdrawal of a drop or two of fluid and demonstration of motile spermatozoa by microscope will show clearly where to make the anastomosis.

In 1907 Hagner and Fuller of Washington (5) reported on two cases of sterility following double gonorrhœal epididymitis where operation was performed, one being done by Hagner and the other by Martin of Philadelphia, the Martin technique being employed in each case. Live spermatozoa were afterward demonstrated in the semen of both patients, but at the time the report was made no pregnancies had yet occurred, though the author remarks "I continue to hope." He adds: "Very few of these operations have been reported."

When William T. Belfield (6) made his address as chairman of the Genito-Urinary Section of the American Medical Association in 1912, he stated emphatically that the investigation of the causes of childlessness should not begin with the curet-

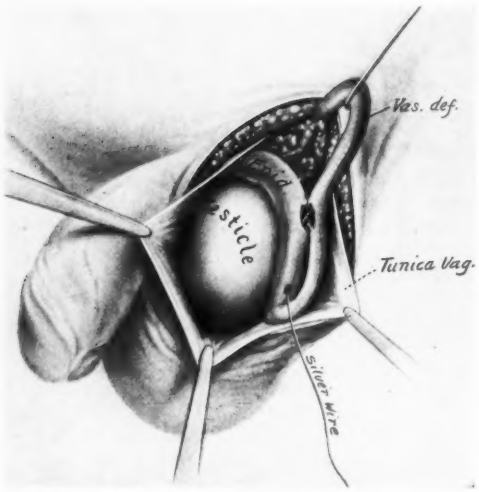

Fig. 1. method of anastomosing vas with epididymis Silver wine place.

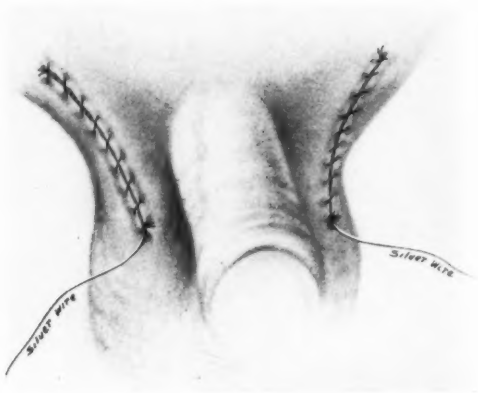

Fig. 2. Appearance of operative field after suture is completed.

tage of the wife, but with microscopic examination of the husband's semen. He went on to speak of the various causes of male sterility, and its treatment, but made no mention of Martin's operation, nor the possible relief of that particular form of sterility by surgical means.

However, by 1915 there was a more general recognition of the practicality and usefulness of "short-circuiting" the vas deferens. McKenna (7) published an account of the work he had done upon dogs, and reported six cases where the operation had been carried out on men. He carefully outlined his technique, which differed considerably from that used by Martin, and emphasized especially the necessity of being sure that the vas was free from all infection and that the section of the epididymis used contained plenty of free sperm; also that the tail of the epididymis should be used for the implantation. Shortly afterward Bernhart (8) in a short article on the technique of the operation stated that, contrary to common supposition, lack of success was not due to the vas failing to remain patulous but rather to the fact that the wound in the head of the epididymis has a tendency to close rapidly. The mere insertion of a strand of silkworm-gut or silver wire into the lumen of the vas deferens was not efficient—in his opinion—to keep the wound in the gland sufficiently open. He then described a loop of wire which he had devised in the hope of overcoming this difficulty. He stated that his technique had proved successful in eight consecutive cases, and that four pregnancies had rewarded his operative efforts.

Yet almost two years after this Wolbarst (9) ignores the work of both McKenna and Bernhart and says: "In gonorrhœal obstruction there is but one measure that offers some degree of hope—the Martin operation—vasoepididymostomy. At best this operation offers no guarantee of success in removing the sterility, but it should be done whenever possible so as to give the patient his only chance." He says: "In a personal experience of 18 patients I have met with gratifying success in one case. Spermatozoa were found in fairly large numbers and moderate efficiency within 4 months and pregnancy followed within a year thereafter." But McKenna continued to offer a much more cheerful outlook for anxious would-be parents. In 1918 (10) he made further reports on successful operations and also gave details of a new technique differing somewhat from that he had used 3 years before. Shortly after this the patient whose case I wish to report presented himself at my office.

H. W. L. first consulted me in April, 1919, concerning his wife. He stated that she was in need of an operation and that he wished to bring her in for examination. In reply to questions he said that his wife's health was good, but after being married for 13 years they were still without children, and he hoped an operation might be performed upon her so that she would be able to become pregnant.

Mrs. L. came in for examination 1 month later. Her history and physical examination were entirely negative. The uterus was of normal size and in good position, the ovaries were palpable and apparently normal and there was no evidence of there having been any trouble in the pelvis. When it was suggested to the husband that he might be the one at fault he declared that he was a "healthy buck" and there was no trouble with him, but questioning

elicited the information that he had had gonorrhœa some 20 years before, for which he had not undergone treatment of any kind and that there had also been a "swollen testicle" on the left side. Several specimens of semen subsequently examined showed a complete azoospermia. Though his general physical condition was negative, on both sides the epididymis was intensely engorged and the vas felt smaller than the normal size. A diagnosis was made of obstruction probably in the globis minor due to the gonorrhœal infection of 20 years before. The operation outlined by Dr. McKenna was explained to the patient and he consented to have it performed.

On May 11, 1919, under local anæsthesia an incision was made over the cord about 2 inches above the testicle, the cord exposed and the vas separated by palpating the cord between the thumb and finger. With a fine knife an incision was made into the vas. A silver wire was then introduced into the lumen of the vas, which was permitted to remain in place with about 4 inches extending into the vas. Next the epididymis was opened about its middle third, and a search made for free spermatoza. The thick creamy fluid resembling pus which immediately gushed out was placed under the microscope and showed many lively spermatozoa. The anastomosis was made by using 00 chromicized catgut. The silver wire was brought through the epididymis and out through the skin wound. Closure was made in the ordinary way, the wire coming out of one end of the wound. The wire was allowed to remain in for a period of 7 days and was then removed. This operation was done on both sides the same day.

As soon as the patient was able to leave the hospital he went to Chicago where he remained for 6 months. On his return to Portland he came in for examination and two different specimens of semen showed many live spermatozoa. His wife who is now 37 years of age is at this time 7 months pregnant.

The technique employed was that of McKenna's later method. He directs that the incision should be made just long enough to expose both vas and epididymis, recalling that the obstruction to the spermatozoa usually occurs in the globis minor. He employs the silver wire because without its use the lumen would fill and become occluded with blood-clot, which would become organized and render the operation of no value.

The results which have been obtained from this operation certainly would seem to justify its employment much oftener than has heretofore been the case.

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TETANUS COMPLICATING DIABETIC GANGRENE

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IN view of the fact that the standard textbooks of medicine, surgery, or even of diabetes do not mention tetanus as a complication of diabetic gangrene, I am reporting a case of this type which has been under observation in the Mayo Clinic. A study of this case seems to demonstrate that tetanus may develop as a terminal infection in patients with diabetic gangrene and that prophylactic treatment is indicated in certain cases.

REPORT OF A CASE

Case 341737. A man, aged 65, was referred to the Mayo Clinic November 23, 1920. He had always been well until the fall of 1917 when he began drinking more than ordinary amounts of water. At Easter time, 1920, his appetite increased noticeably; the total urinary output was doubled. Three weeks before he came to the Clinic pain appeared in the great right toe which soon began to take on a purplish color, later turning black, and losing sensation. The day preceding his admission there had been a spontaneous discharge of foul-smelling, yellowish-white material from the plantar surface of the toe. During the previous 2 years he had lost 55 pounds in weight, and had lost strength progressively. Besides these symptoms he had numbness and tingling of all his fingers extending up to the metacarpal phalangeal joints, which is characteristic of the nervous system involvement in late cases of diabetes mellitus.

An unusual detail obtained from the history was that the patient's urine had never been examined for sugar. On examination he was noticeably pale and emaciated. The great toe of the right foot was black up to the metatarsal phalangeal articulation. A purplish area of discoloration extended upward on the dorsal surface of the foot feathering out around the proximal end of the metatarsals. The pupils were miotic and did not react to light. Examination of the eye grounds showed nothing abnormal other than some fullness of the veins. The teeth were carious, the tonsils enlarged and ragged, and a few white plugs were expressed from their crypts. Palpable glands were noted in the supraclavicular fossæ. The thyroid was slightly enlarged, but no adenomata were palpated, nor were there signs of exophthalmic goiter. The peripheral arteries were markedly sclerosed, and rolled under the finger like a non-elastic tube. Over the discolored area of the right foot sensation was absent, and pulsation was not felt in the right posterior tibial artery. A 12-hour specimen of urine revealed 6 per cent sugar in 900 cubic centimeter, a specific gravity of 1,020, a large albumin content, and occasional hyaline and granular casts. The blood sugar was 0.15 per cent, estimated according to Folins' method, and the alkaline reserve of the blood plasma was 56 volume per cent, with the Van Slyke apparatus.

A diagnosis of diabetes mellitus with gangrene was made November 23; the patient was placed in the hospital and given a diet containing 150 grams carbohydrate, 60 grams protein, and 60 grams fat. November 27, he suddenly complained of stiffness in his neck and could not open his mouth more than half way. The following morning flexion of his neck was painful and the abdominal muscles were contracted. During the next 20 hours spasm of the masseters with grinding of the teeth occurred every 10 or 15 minutes. Death occurred about 30 hours after the onset of symptoms.

When the symptoms of tetanus were first noticed, a smear from the gangrenous area of the right foot showed tetanus bacilli, thus establishing the diagnosis. The patient's toe was not amputated because of his general condition. He was treated with antitetanic serum intravenously, intraspinally, and intramuscularly without appreciable effect.

The original source of the infection is uncertain, but the patient's daughter volunteered the information that the infected toe had never been covered by a dressing and had been in direct contact with a black sock. Treatment in such cases after the tetanus is well established will not be of much benefit, consequently prophylactic antitetanic serum is indicated.

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EDITORIALS

SURGERY, GYNECOLOGY AND OBSTETRICS

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ALLEN B. KANAVEL, M.D. .....Associate Editor

JANUARY, 1922

EDITORIAL FOREWORD

THE journal of SURGERY, GYNECOLOGY, AND OBSTETRICS is the official organ of the American College of Surgeons. The editors are fellows of the College and the majority of the editorial staff are members of the Board of Regents of the College who serve in this capacity ex officio. Through the generosity of the founder of SURGERY, GYNECOLOGY AND OBSTETRICS, Dr. Franklin H. Martin, arrangements have been made whereby the journal will eventually become the property of the American College of Surgeons.

During the years of its existence the Journal has ever maintained a high standard of scientific excellence. To speak further of the great work that has been accomplished by the journal in the advancement of surgery would be super-arrogation. The publication of extensive collective reviews in which a surgical subject of importance has been brought fully up-to-date has proved to be of great value, especially to those interested in the subject reviewed. The editorial board has decided to establish a department of editorials in which some surgical subject will be more briefly placed before the surgical profession by a recognized authority. It is hoped that these short editorials will be of value not only to those specially interested in the subject discussed but by their brevity will also appeal to the surgical profession as a whole.

WILLIAM J. MAYO,
Chairman, Editorial Staff
for the American College of Surgeons.

HIRSCHSPRUNG'S DISEASE

IN an interesting paper, read before the American Surgical Association at its last meeting and published in a recent number of the *Annals of Surgery*, Dowd has brought the question of the surgical treatment of megacolon pretty well up-to-date. He has also compiled a list of the literature upon the subject published since 1908, supplementing the list collected by Finney at that time.

During the last 13 years, while much has been written on the subject, little of value has been added to our knowledge of the etiology of the disease, and it must be admitted even now that little definite is known as to the true causation of the affection. Evidence is accumulating all the time to support the contention that in many cases at least no single cause is responsible for the various manifestations that have been noted from time to time by different observers. In all probability more than one factor is involved. The fact that so many theories as to its etiology have been advanced is the best evidence as to the uncertainty of our knowledge of the subject. These various theories may be roughly stated as—

1. Some congenital developmental defect in the colon. Hirschsprung, whose name has been given to this disease, was a strong

advocate of this theory. He believed that both the dilatation and hypertrophy which have been noted as present are congenital in origin. Many later writers, notably Mya, Billard, Hobbs and De Richmond, Joukovsky, and others support this contention by reports of autopsies of fœtus and young children born with various forms of dilatations and hypertrophies, chiefly of the lower bowel. Analogies of these localized ectasias are to be found in other parts of the intestinal tract—the œsophagus, rectum, etc. While it is quite likely that the two conditions of dilatation and hypertrophy are not inseparably bound together, as a matter of fact, however, they are both noted as present in almost every case reported. It is conceivable that either of these processes may be primary and the other secondary. Dilatation, however, appears to be of relatively greater etiological importance than hypertrophy, which is more apt to be secondary and functional.

Concetti advances the idea of a congenital aplasia of the muscular tunics of the large intestine immediately above the rectum. Growing out of this, as a result of the processes of fermentation and putrefaction and the formation of gases resulting therefrom, there develops a well-marked ectasia of the intestine which, in turn, sooner or later, becomes distended with large quantities of accumulated fæces.

Hawkins proposed the name of "neuropathic dilatation and hypertrophy of the colon," basing it on his conception of the etiology of the disease as a neuromuscular defect in one segment through which the colon was unable to propel its contents. This theory was also held by Formad, Lennander, Bing, and others. Richardson and Fitz called attention to the close relationship existing between this condition and phantom tumor, as showing a possible nervous origin.

2. Some form of mechanical obstruction producing conditions due directly to efforts to overcome the obstruction. These obstructions may assume various forms. Barth, for instance, thought them due to a secondary torsion of the sigmoid, the result of an abnormally long mesentery. Others, on the other hand, think an abnormally short mesentery is the cause. The increased length of the colon and a multiplication and exaggeration of its loops, especially of the sigmoid flexure, was believed by Marfan and Neter to be the cause of the trouble, the subsequent dilatation and hypertrophy being dependent on the accumulation of gas and faces in the elongated loops of the colon.

Curshmann, in Nothnagel's *System*, states that the sigmoid in early life is relatively larger than the rest of the large intestine and that we may often find a persistence of the infantile condition which may at times become "monstrous." Hirschsprung rather inclined in his later writings to this idea. Treves was a strong advocate of the mechanical obstruction theory. He insisted that the phenomena observed in this connection suggest in a most emphatic way that there is an obstruction to be overcome and that the hypertrophy is quite inconsistent with the conception of an "idiopathic" dilatation of the bowel.

Perthes, in an elaborate report, contends that valve-formation in the intestine was responsible in his case for the condition found. He thought he was able to demonstrate a definite valve action just below the distended portion. This idea of the valve-formation, as the chief etiological factor in the disease, is shared by many others. Roser, for instance, describes several different ways in which a valve may be formed in the intestine and has demonstrated conclusively that under certain circumstances it is actually

accomplished. The idea of the obstruction from valve-formation is that generally accepted by many of the Continental authors. Pressure from neighboring organs, adhesions, etc., have been suggested by others as possible explanations.

3. A tonic contraction or spasm of the circular fibers in the lower part of the intestine. This is the prime cause, the dilatation and hypertrophy following as a result. Fenwick, Gee, Hitchins, and others report cases in which a definite spastic contraction of the sphincter ani was observed associated with fissures in the anal margin.

Unfortunately, none of these theories explains all cases, and in a goodly number of those cases that have been reported, no satisfactory explanation of the phenomenon observed has been found. The clinical picture is one that is usually easily recognized and little need be said about it.

The surgical treatment has been only fairly satisfactory owing largely to the fact that the patients are usually in poor physical condition and hence bad surgical risks. Dowd points out that surgical treatment is more successful than medical in the proportion of about 6 to 4. Many forms of surgical treatment have been recommended. The operative mortality in recent years has undoubtedly improved, owing to the more general use of rational surgical procedures. His table of 136 cases shows a mortality rate of 28.7 per cent, a very satisfactory showing, all things considered.

Dowd divides the operative procedures into three main classes: (1) those for whom only a colostomy or an appendicostomy was done; (2) those for whom there was some semi-palliative procedure done, such as short-circuiting, colopexy, relief of volvulus, colon-plication, etc.; (3) those for whom more or less of the colon was resected. The first two groups which are chiefly palliative need not be considered further, as they are not advised except in cases where for some reason or other a more radical curative procedure is contra-indicated. The present attitude of mind among most surgeons is in favor of removing as much of the enlarged colon as seems advisable or practicable. In order to accomplish this, three main methods have been employed: (1) The so-called one-stage operation, removal of the dilated portion of the colon and reuniting the divided ends intra-abdominally by some one of the accredited methods of intestinal anastomosis. (2) The so-called two-stage method of intra-abdominal resection. There are many variations of this method, either with or without a preliminary colostomy for emptying and irrigating the colon before resection, and providing a vent thereafter. (3) Extra-abdominal resection, generally done in two or more stages, the so-called "Mikulicz" method. The portion of the colon to be removed may be delivered through a separate opening in the abdominal wall which is preferable, or through the original incision. In all probability, the last-named method is the one of choice in the majority of cases, since it is attended by a much lower mortality rate than the others, and since the ultimate results have proved quite satisfactory. It has the obvious disadvantage of taking a longer time to secure the desired result than some of the others, but, on the other hand, the proportion of cases of megacolon suitable for a one-stage resection is relatively small. The chief dangers in the operation are the poor condition of the patient, the risk of sepsis, since these colons are particularly foul, and the shock of the operation due to extensive resection.

As pointed out by Dowd, the so-called two-stage extraperitoneal resection of Mikulicz has not been up to the present time very

popular, but to the conditions that exist in this particular affection it seems perhaps better adapted than any of the methods of resection hitherto employed.

J. M. T. FINNEY.

ACUTE PLEURAL EMPYEMA

THE problems associated with acute pleural empyema loom large in the daily routine of the general practitioner, the internist, and the general surgeon.

Forty years ago the routine treatment was aspiration and the important detail was to aspirate the fluid without permitting air to enter the pleural cavity. The persistent chronic cases were treated by drainage, the tube being passed through one of the intercostal spaces.

Then came the practice of rib resection and drainage, the object being to secure more efficient and thorough emptying of the plural sac, using a larger tube and avoiding pressure necrosis of the ribs. This was regarded as a distinct advance and, indeed, it was. The tube caused less discomfort, and opportunity was afforded to remove masses of fibrin and thus shorten the period of convalescence.

The experiences of the training camps during the scourge of influenza,—which so frequently produced a virulent empyema,—that swept through America in 1918, and of the late war changed our views on many points relating to the pathogenesis and treatment of empyema, infected joints, and the infected abdomen.

The mortality rate was lowered by the return to the use of the aspirator, and a less frequent use of the drainage tube.

In civil practice the more common source of infection is undoubtedly the lung and the visceral pleura, although infection through the diaphragm is probably more frequent than is sometimes realized. Occasionally the original focus may be in the parietal pleura.

The presence of fluid in the cavity of the pleura is not difficult to recognize and yet from time to time, one hears of cases of *empyema necessitas* and of rupture into the bronchus followed by death from drowning. Delayed resolution of a pneumonia should always suggest the possibility of a pleural effusion as the cause, and a report from the nurse or the mother that there has been an attack of dyspnœa during the night should confirm the suspicion of lung compression. The point is so easily settled by a small exploring needle that one wonders why pleural effusion is ever overlooked.

An empyema differs from an abscess in the abdomen, for instance, in having one rigid wall. This fact makes it all-important that the pus should be removed before the visceral pleura becomes so thick that it prevents the lung from expanding and resuming its place against the ribs.

No doubt the variety of infection plays an important part in the prognosis and treatment, hence the value of a combined cytological and bacteriological examination of the fluid withdrawn. Aspiration, repeated several times if necessary, favors lung expansion and may be all that is required. If there is found to be a tendency to recurrence and chronicity, then is the time for drainage, but drainage with every precaution against infection from without, and for a limited period of time. Finally if the pleural sac is rendered sterile or nearly so by Dakin solution or other agents, closure of the opening without drainage gives admirable results in many cases, even in those in which aspiration is indicated, and may need to be repeated several times during convalescence.

The sooner these patients can be got out of bed and encouraged to move about in the fresh air the more quickly do they recover.

G. E. ARMSTRONG.

THE MANAGEMENT OF GASTRIC AND DUODENAL ULCER

ONE of the most striking facts in connection with chronic ulcer of the stomach and duodenum is the number of earlier conceptions which have undergone great changes during the past few years. The evolution of ideas with regard to such ulcers has been synchronous with the surgical treatment of the disease, and it is doubtful that the knowledge thus obtained could otherwise have been acquired. In spite of the present wealth of accurate information, however, many questions are still unsettled and consistently satisfactory treatment of the disease cannot be expected until they are solved.

Although the cause of ulcer is not clearly understood, probably because of its complexity and the close relationship to the neurogenic system, it is significant that it is rather generally agreed that the selective localization of pathogenic bacteria is, as shown by Rosenow, a most important factor. Until the cause of chronic ulcer is sufficiently understood so that it may be recognized and adequately dealt with, the diagnosis and treatment of the disease are the chief concern.

The great value in the close association of the well-qualified internist, roentgenologist, pathologist, and surgeon is particularly well exemplified in the interpretation of gastric symptoms, and their composite opinion will be correct in 95 per cent of cases. In no other intra-abdominal disease has diagnosis become so accurate as in chronic gastric and duodenal ulcer, and it is to the screen and the plate, in experienced hands, that a large measure of the success in attaining this efficiency must be accorded.

Such an efficient method has led to one difficulty, namely, the tendency to forget the patient and his complaint in the presence of visible abnormalities or disease. The danger of such an attitude has been emphasized in several recent papers and is a timely warning in view of the rather large margin of error in the roentgenological diagnosis of ulcer in the hands of the inexperienced. The opinion of the well-trained clinician, who is able properly to evaluate special diagnostic aids and is familiar with the results of methods of management, continues to be the most reliable basis on which to determine the best course for the patient.

The principles of treatment of gastric and duodenal ulcer are becoming quite generally agreed on. However decided surgeons may be that chronic duodenal and gastric ulcers are surgical conditions, they also recognize that there is a stage in the development of the lesion during which it may well be subjected to medical management alone. The number of early ulcers which heal spontaneously or are permanently cured by medical means can not be determined because of the difficulty of recognition. It will be an even greater problem to learn why some ulcers heal and why others, under apparently similar conditions, become chronic. Most surgeons agree that every early ulcer should have a thorough trial of cure under medical régime, if the patient can afford the time and expense necessary. When, in spite of treatment, an ulcer becomes chronic and recurrent, the best immediate and late results are achieved by surgery.

Surgeons are not in complete agreement as to the best method of surgical management. This is fortunate since the difference of opinion will bring out the truth more rapidly

than will blind adherence to a standard method of treatment. In any discussion of the relative merits of the different operations for gastric and duodenal ulcer, it should not be forgotten that gastro-enterostomy and its results brought about and justified the adoption of surgical measures in the treatment of ulcer. Another point which is often overlooked is that gastric and duodenal ulcers are distinct entities and should always be so considered, particularly from the standpoint of their surgical management.

A further suggestion might be made, that the surgical management of ulcer should always be discussed on the basis of size, situation, character, and complications. An operation which may be clearly indicated for one ulcer may be quite ineffective in another. The trend of development in the surgical management of chronic gastric and duodenal ulcer has been toward more radical measures.

The desirability of excising a gastric ulcer, unless local conditions contra-indicate, is now quite generally accepted and in ulcers which have been associated with bleeding the wisdom of destruction or excision is obvious. Gastric resection for gastric ulcer and pylorectomy or partial duodenectomy for duodenal ulcer is now being advocated by British and continental surgeons. Such procedures mark the limits of surgery, at least from a technical point of view. Whether the ultimate results of partial gastrectomy for ulcer will prove to be better than the results which follow local excision of the lesion by knife or cautery combined with gastro-enterostomy or pyloroplasty is a question. If the results are better, the question arises whether they are sufficiently so to offset the added risk of the radical operation, especially in inexperienced hands. For sound reasons the excision of the duodenal ulcer combined with the pyloroplasty of Finney is gaining favor with the surgical profession when it can be done without more risk than gastro-enterostomy with cautery or knife excision.

The subsequent course of patients operated on for gastric ulcer is not so satisfactory as the course of those operated on for duodenal ulcer. The subsequent death rate in duodenal ulcer is not higher than the death rate in the general population of similar age and sex, but the subsequent death rate following operations for gastric ulcer is three times the average death rate in a corresponding group of persons in the general population. Gastric ulcer is a much more serious malady from all standpoints than duodenal ulcer, and the fact may be emphasized that these diseases should always be considered and discussed independently.

The liability of cancer after operations for gastric ulcer (a liability which is present after all types of operation, including gastric resection), the occurrence of secondary ulcers which may also be sequels to any gastric operation, postoperative hæmorrhage, and the varying results in apparently identical cases subjected to the same treatment, are only a few of the questions, further knowledge of which will be important to this ever-interesting subject.

DONALD C. BALFOUR.

CORRESPONDENCE

CANCER OF THE AMPULLA OF VATER

To the Editor: Since the publication of my article on "Cancer of the Ampulla of Vater," in the June, 1921, number of SURGERY, GYNECOLOGY AND OBSTETRICS, my attention has been called by Dr. Gustav Pallin, surgeon to the University of Lund, to an excellent article of his in Bruen's *Beitraege zur klinische Chirurgie*, cxxi, No. 1, "Das Carcinom des Ductus hepatico-choledochus und seine chirurgische Behandlung." In this article Pallin refers to several cases of cancer of the ampulla of Vater treated by radical operation which I had failed to find in the books of reference at my disposal. I, therefore, take pleasure in summarizing the cases reported in Pallin's article, thus rendering my article more complete and at the same time acknowledging the work that Pallin has done.

CASE 1. Operated upon by Rixford in 1901. Cholecystostomy. Operative recovery 4 months later. Recurrence.

CASE 2. Operated upon by Voelcker in 1904. Transduodenal excision with hepatic drainage. Died in 2 days.

CASE 3. Operated upon by Morian in 1908. Transduodenal excision with cholecystojejunostomy. Operative recovery. Later metastasis.

CASE 4. Operated upon by Akerblom in 1912. Transduodenal excision with cholecystostomy. Died in 9 days.

CASE 5. Operated upon by Hirschel in 1913. Resection of duodenum; end-to-end anastomosis; resection of part of pancreas; gastro-enterostomy. Well after 1 year. Apparent recurrence.

CASE 6. Operated upon by Clermont in 1913. Transduodenal excision. Died.

CASE 7. Operated upon by Docq-VanPsever in 1914. Transduodenal excision. Operative recovery.

CASE 8. Operated upon by Docq-VanPsever. Transduodenal excision. Died on fourth day.

CASE 9. Operated upon by Wrede, in 1914. Transduodenal excision. Operative recovery.

CASE 10. Operated upon by Wrede in 1914. Transduodenal excision. Died.

CASE 11. Operated upon by Wrede in 1905. Transduodenal excision. Drainage of common duct. Operative recovery.

CASE 12. Operated upon by Akerblom. Transduodenal excision. Cholecystectomy. Died in 2 days.

CASE 13. Operated upon by Lundblad in 1919. Transduodenal excision. Died.

Three other cases by W. Mayo, Riecel and Czerny, died following operations or from recurrence.

ROBERT M. LEWIS, M.D.

Baltimore.

PRE-OPERATIVE PREPARATION OF PATIENTS WITH OBSTRUCTIVE JAUNDICE

A CORRECTION

In the article by Dr. Waltman Walters in the December, 1921 issue of SURGERY, GYNECOLOGY AND OBSTETRICS, line 40, page 655, third paragraph, should be corrected to read "from 20 to 34 hours after the removal of the." M. H. MELLISH, Editor

Rochester, Minn. *Mayo Clinic*

BOOK REVIEWS

A CRITIQUE OF NEW BOOKS ON GYNECOLOGY AND OBSTETRICS

IN a long preface of 6 pages Roberts and Kelly[1] mention the influence of the war, the necessity for massage, and the teaching of early American authors on fractures. An outline summary of the material included in this new edition presents the authors' views on fractures, and the twenty-fourth point of the summary, which advises that "Joint fractures should not be kept immobile longer than one or two days; careful passive and active movement usually should be allowed within the first few days" might well be said in large type.

The first 138 pages are devoted to general remarks on fractures and are full of meaty material set down in a fashion which invites easy reading. The general chapter on treatment is particularly good; warning is again made against untrained operative interference on fractured bones. The use of the Lane plate is favored. One is pleased to find the meaningful term "open and closed fracture" used in the text.

There is much lacking in the description of the mechanism of fracture that has already found acceptance in the literature of the subject. Also the description of the symptoms of fracture fail to lay sufficient stress on the importance of localized tenderness and pain. Fractures of the carpal bones are given scant space. Regarding the valuable constant traction treatment for metacarpal and phalangeal fractures, no illustrations are given and little is said. It is to be regretted that there is not one specific reference to the literature in the whole book.

The remarks on the use of the X-ray in diagnosis and as a correction of treatment are good. A chapter on epiphyseal separations is helpful. After the discussion of treatment of fractures of important bones there is given a summary to bring out the points requiring attention. Obstetric fractures are allotted a short chapter at the close of the book, followed by a final one on industrial and war fractures. By war fractures, of course, is meant projectile fractures, caused by the projectiles fired from the weapons of war. There are many ordinary closed fractures among soldiers during war times which are exactly like civil fractures in peace time. A criticism might be made of the attempt in an authoritative textbook to deal with projectile and industrial fractures in so inadequate a space.

From a general viewpoint the grouping of illustrations and the reproduction of roentgenograms are excellent. In the first third of the volume, however, many of the roentgenograms fail to betray to the readers' eye the existing lesion; possibly it was evident to the authors in the original plates. The photographs of methods of treatment, except operative treatment, and especially those of specimens, are clear and businesslike. One photograph of the same leg with a Buck's extension applied is reproduced three times. Both students and practitioners will welcome this up-to-date edition with its wealth of illustrations. KELLOGG SPEED.

THIS little book,[2] now in its third edition, presents a concise and correct account of the more important facts of regional anatomy. The text is lucid and the material presented has been carefully selected. The author has wisely chosen to confine his attention to the structures and relations of greatest practical importance, emphasizing and elucidating them by brief references to their clinical applications, and has left to textbooks of surgery the non-anatomical details which encumber most texts of surgical anatomy.

The book would, however, have a greater field of usefulness if the illustrations were of better quality and furnished in greater number. Moreover, the author continues to use the old English terminology and has not even seen fit to include the B. N. A. terms in parenthesis. Since the Basle Anatomical Nomenclature is now employed in nearly all the larger texts and atlases of anatomy used in this country, American medical students are more familiar with the new than with the old terms and the usefulness of the book has thereby been considerably impaired. S. W. RANSOM.

THE work[3] before us is brimful of just the information needed by the radiologist for the rational analysis and interpretation of the X-ray plates of bone and joint disease. Liberal space is devoted to fractures, but the more important and highly valuable portion of the work is the major section devoted to the elucidation of Baetjer's well-known philosophy of bone shadow interpretation.

[1] TREATISE ON FRACTURES IN GENERAL, INDUSTRIAL AND MILITARY PRACTICE. By John B. Roberts, A.M., M.D., F.A.C.S., and James A. Kelly, A.M., M.D. 2d ed. revised and entirely reset. Philadelphia and London: J. B. Lippincott Co., 1921.

[2] A MANUAL OF SURGICAL ANATOMY. By Charles R. Whittaker, F.R.C.S. (Ed.), F.R.S.E., 3d. ed., revised and enlarged. New York: William Wood & Company, 1921.

[3] INJURIES AND DISEASES OF THE BONES AND JOINTS. Their differential diagnosis by means of the roentgen rays. By Frederick H. Baetjer, M.D., and Charles A. Waters, M.D. New York: Paul B. Hoeber, 1921.

The work abounds with axiomatic truths which cannot be too often emphasized. "Roentgenology is not a picture process but a medical procedure based upon careful analysis and logical deductions from the shadows observed upon a plate and the translation of these shadows into pathological terms. . . . The ability of the roentgenologist depends not so much upon his technical skill as upon his familiarity with the general problems of medicine and surgery."

American roentgenology is proud of this work which is bound to make itself felt very promptly in greatly improved averages of success in the X-ray diagnosis of bone and joint lesions.

JAMES T. CASE.

DELAYED in publication by the World War, this, the second edition of the *American Year-Book of Anæsthesia and Analgesia*[1] covers the advances in the science and practice of anæsthesia and analgesia during 1917–1918. The collected papers and researches are contributed by eminent authorities of the allied professions who are vitally interested in current advances. The several chapters devoted to anæsthesia at the front and war surgery of the base and reconstruction hospitals will be found valuable for future military use, as well as in industrial surgery. Of special interest are the studies in the pharmacophysiopathology of anæsthesia and analgesia which have a direct bearing on the clinical handling of patients submitting to operation under narcosis. Contributions on the newer local anæsthetics, their pharmacology, comparative toxicity and value in local anæsthesia in general surgery and in dentistry and oral surgery are presented as well as pertinent papers on anæsthesia and analgesia in obstetrics which are of practical value.

An added feature of this edition is the cumulative index of the world literature for 1917–1918 which is developed under subject headings, and which makes a convenient bibliography for reference.

ISABELLA C. HERB.

GENERAL pathology,[2] conceded to be the foundation of medical science and practice, is nevertheless, likely to be neglected in the reading of the average clinician. The work by Oertel is an admirable outline of the subject, clear, concise, and readable. Pathological processes are interpreted as physicochemical cell alterations and disturbed cell relations which follow common biological laws and which, in most instances, find definite anatomical expression. The attempt is made to present pathological anatomy and histology in such a manner that the processes of disease may be clearly visualized. The historic development of present ideas is traced.

The volume, intended as an introduction to the study of medicine, covers a broad field in general outline. It contains only 357 pages. An extensive bibliography has been omitted; there are no illustrations. For use as a text supplementary laboratory experience is assumed. The discussion of etiology comprises 160 pages, possibly a disproportionate number; pathological anatomy, histology and pathogenesis are treated in 189 pages. Disposition and heredity receive unusually clear and detailed discussion.

The value of the work lies chiefly in its conciseness and clearness of expression, in its interpretation of pathology as changes in cells and their relations produced in accordance with biological laws, and in its emphasis on visualization of the pathological picture. This book should prove stimulating both to the graduate and to the student of medicine.

W. H. NADLER.

WHEN as students in medical school we were attempting to lay a broad foundation for our medical knowledge, to systematize the numerous ideas that were thrown at us, pell-mell as it were, in different clinics, and when as seniors we were trying to encompass all knowledge in a heroic attempt to best our competitors in hospital examinations, two textbooks stood out in our minds as particularly helpful and valuable—Osler's *Medicine* and Stewart's *Manual of Surgery*.[3]

The appearance of the fifth edition of the latter, published after the death of its gifted author, with the assistance of Dr. Walter Estell Lee, makes us realize anew the sense of personal obligation we always felt to Doctor Stewart for his concise, clear cut, and admirably simple presentation of the principles and practice of surgery.

The edition in question is considerably larger than its predecessors, due to numerous additions, and to a different "make-up." It has been carefully brought up to date by the inclusion of the lessons learned from the war—particularly those concerning the treatment of infected wounds of the various regions of the body, the treatment of fractures, of nerve injuries, and of shock. The sections dealing with plastic surgery, with the treatment of empyema, with the surgery of the abdomen, reflect the ideas of a surgeon of skilled judgment, thoroughly abreast with the advances being made in varied fields.

No textbook, particularly in medical fields, is perfect. The inclusion of old illustrations, such as that illustrating obsolete methods of nerve anastomosis, of obsolete procedures such as the majority of those mentioned in the treatment of trigeminal neuralgia, the omission of mention of the ordinary Thomas splint for the treatment of fractures of the lower extremity, or of the Jones modification of the Thomas arm splint for fractures of the humerus, the failure to mention the importance of a metabolic rate determination in the diagnosis of

[1] THE AMERICAN YEAR-BOOK OF ANÆSTHESIA AND ANALGESIA, 1917–1918. F. H. McMechan, A.M., M.D., Editor. New York: Surgery Publishing Company, 1921.

[2] GENERAL PATHOLOGY; an introduction to the study of medicine. By Horst Oertel. New York: Paul B. Hoeber, 1921.

[3] A MANUAL OF SURGERY; for students and physicians. By Francis T. Stewart, M.D. 5th ed. Philadelphia: P. Blakiston's Son & Co., 1921.

a toxic goiter, are illustrations of small imperfections well-nigh unavoidable. We feel that a little more definite reference to sources, to those who have contributed largely in special fields would have added to the value of the volume.

Minor omissions and slight imperfections, however, do not affect our belief that the author has left behind him an enduring monument, both to his ability as a writer, and to his skill and judgment as a surgeon. S. L. KOCH.

BOOKS RECEIVED

Books received are acknowledged in this department and such acknowledgment must be regarded as a sufficient return for the courtesy of the sender. Selections will be made for review in the interests of our readers and as space permits.

INDISPENSABLE ORTHOPÆDICS; A HANDBOOK OF TREATMENT. By F. Calot. 2d English ed., translated from 7th French ed. By A. H. Robinson, M.D., M.R.C.S. 2 vols. St. Louis: C. V. Mosby Company, 1921.

AIDS TO OPERATIVE SURGERY. By H. C. Orrin, O.B.E., F.R.C.S.(Ed.). New York: William Wood & Company, 1921.

GREEK MEDICINE IN ROME; THE FITZPATRICK LECTURES ON THE HISTORY OF MEDICINE DELIVERED AT THE ROYAL COLLEGE OF PHYSICIANS OF LONDON IN 1909–1910 WITH OTHER HISTORICAL ESSAYS. By The Right Hon. Sir T. Clifford Allbutt, K.C.B., M.A., M.D., F.R.C.P., etc., New York: The Macmillan Company, 1921.

ESSAYS ON SURGICAL SUBJECTS. By Sir Berkeley Moynihan, K.C.M.G., C.B. Philadelphia and London: W. B. Saunders Company, 1921.

LIFE AND TIMES OF AMBROISE PARÉ (1510–1590) WITH A NEW TRANSLATION OF HIS APOLOGY AND AN ACCOUNT OF HIS JOURNEYS IN DIVERS PLACES. By Francis R. Packard, M.D. New York: Paul B. Hoeber, 1921.

THE TECHNIC OF THE CHICAGO LYING-IN HOSPITAL AND DISPENSARY. By Joseph B. DeLee, M.D., 1921.

INDEX-CATALOGUE OF THE LIBRARY OF THE SURGEON GENERAL'S OFFICE, UNITED STATES ARMY. Authors and Subjects. 3d series, vol. ii,—Arnal-Blondlot. Washington: Government Printing Office, 1920.

REPORT OF THE SCIENTIFIC WORK OF THE SURGICAL STAFF OF THE WOMAN'S HOSPITAL IN THE STATE OF NEW YORK. Edited by George Gray Ward, Jr., M.D., F.A.C.S., vol. iii, 1920.

A TEXTBOOK OF MIDWIFERY FOR MEDICAL SCHOOLS AND COLLEGES IN INDIA. By Kedarnath Das, C.I.E., M.D. Calcutta and Simla: Thacker Spink & Company, 1921.

THE PRACTICE OF UROLOGY; A SURGICAL TREATISE ON GENITO-URINARY DISEASES INCLUDING SYPHILIS. By Charles H. Chetwood, M.D., LL.D., F.A.C.S. 3d ed. New York: William Wood & Co., 1921.

MODERN ITALIAN SURGERY AND OLD UNIVERSITIES OF ITALY. By Paolo di Vecchi, M.D. Foreword by George D. Stewart, M.D. New York: Paul B. Hoeber, 1921.

LIPPINCOTT'S NURSING MANUALS. Surgical and Gynæcological Nursing. By Edward Mason Parker, M.D., F.A.C.S., and Scott Dudley Breckinridge, M.D., F.A.C.S. 2d ed. revised. Philadelphia and London: J. B. Lippincott Company, 1921.

LES FISTULES JÉJUNO-COLIQUES PAR ULCÈRE PERFORANT APRÈS GASTRO-ENTÉROSTOMIE. By Docteur Georges Loewy. Paris: Imprimerie E. Desfossés, 1921.

COLLECTED PAPERS OF THE MAYO CLINIC, ROCHESTER, MINNESOTA. Edited by Mrs. M. H. Mellish. Vol. xii, 1920. Philadelphia and London: W. B. Saunders Company, 1921.

DIAGNOSTISCHE UND THERAPEUTISCHE IRRTUEMER UND DEREN VERHUETUNG. FRAUENHEILKUNDE UND GEBURTSHILFE. By Prof. Dr. J. Schwalbe. 5 monographs. Leipzig: Georg Thieme, 1921.

OBSTETRICS AND GYNÆCOLOGY. Edited by John S. Fairbairn, M.A., B.M., B.Ch.(Oxon.), F.R.C.P.(Lond.), F.R.C.S. London: Oxford University Press, 1921.

CLINICAL DIAGNOSIS FOR STUDENTS AND PRACTITIONERS. By F. DeQuervain. 3d English ed. translated from the 7th ed. by J. Snowman, M.D. New York: William Wood & Co., 1921.

ATLAS FOR ELECTRODIAGNOSIS AND THERAPEUTICS. By F. Miramond de Laroquette, M.D. Authorized translation by Mary Gregson Cheetham. Foreword by Robert Knox, M.D. New York: Paul B. Hoeber, 1921.

DIAGNOSIS BY TRANSILLUMINATION. Chicago: Cameron's Surgical Specialty Company, 1921.

VICE AND HEALTH PROBLEMS—SOLUTIONS. By John Clarence Funk, M.A., LL.B. Philadelphia and London: J. B. Lippincott Company, 1921.

TRAITE D'UROLOGIE. By G. Marion. 2 vols. Paris: Masson et Cie, 1921.

A TEXTBOOK OF SURGICAL ANATOMY. By William Francis Campbell, A.B., M.D., F.A.C.S. 3d ed. revised. Philadelphia and London: W. B. Saunders Co., 1921.

THE LIFE OF JACOB HENLE. By Victor Robinson, M.D. New York: Medical Life Company, 1921.

THE SPLEEN AND SOME OF ITS DISEASES BEING THE BRADSHAW LECTURE OF THE ROYAL COLLEGE OF SURGEONS OF ENGLAND, 1920. By Sir Berkeley Moynihan. Philadelphia: W. B. Saunders Company, 1921.

HEART DISEASE AND PREGNANCY. By Sir James MacKenzie. London: Oxford University Press, 1921.

EPHRAIM MCDOWELL "FATHER OF OVARIOTOMY" AND FOUNDER OF ABDOMINAL SURGERY. With an appendix on Jane Todd Crawford. By August Schachner, M.D., F.A.C.S. Philadelphia and London: J. B. Lippincott Company, 1921.

ANNEXITES NONINFECTIEUSES; MALADIES DE L'OVULATION. By Dr. Paul Dalché. Paris: L'Expansion scientifique Française, 1921.

PNEUMOPERITONEAL ROENTGEN-RAY DIAGNOSIS. (A Monograph with Atlas.) By Arthur Stein, M.D., F.A.C.S., and William H. Stewart, M.D., F.A.C.P. Troy, New York: The Southworth Company, 1921.

AMERICAN COLLEGE OF SURGEONS

REPORT OF THE HOSPITAL CONFERENCE HELD AT THE CLINICAL CONGRESS OF THE AMERICAN COLLEGE OF SURGEONS OCTOBER 24, 1921, PHILADELPHIA[1]

MORNING SESSION—THE PRESIDENT, GEORGE E. ARMSTRONG, M.D., PRESIDING

HOSPITAL STANDARDIZATION, ITS INCEPTION, DEVELOPMENT, AND PROGRESS IN FIVE YEARS

BY FRANKLIN H. MARTIN, M.D., CHICAGO
Director-General of the American College of Surgeons

YOU have all undoubtedly asked yourselves why this program of the American College of Surgeons has been received with so much approval, why it has attracted so much attention, why it has had so much influence.

Scientific medicine is developing so rapidly that of necessity it is reducing the number of the medical profession in proportion to the people they have to care for. Medicine, therefore, is becoming more wholesale and institutional, less retail and domiciliary. That of necessity has placed an enormous responsibility upon the hospital, because the hospitals must be the institutions in which the wholesale or group medicine is practised.

The American College of Surgeons is responsible for the standardization of hospitals, because in its early days it found it necessary to standardize its own environments. For instance, in making a standard for admission to fellowship, it was necessary that we ask the candidates to furnish us the reports of fifty major operations and fifty minor operations, in lieu of an examination. These reports began to come in. They were on all kinds of forms. There was absolutely no standard record on which they could give us the evidence of their own ability to practise surgery. Soon we were asked from every direction to furnish a standardized system of records, to suggest a form upon which these records could be given to the College. We attempted to do that. A committee was formed for the purpose, and we furnished, wherever required, a set of standardized records. Then what happened? The hospitals—a great many of them—began to ask us if we could not in some way furnish these same standardized records or forms to them, which, of course, we were very glad to do.

That was the first step in the standardization of hospitals. Then, early during the war, it became necessary for us to have some other minimum standards that would apply to the hospitals in the camps, the army hospitals. And in Washington was called a conference of medical officers and we discussed a minimum standard for military hospitals.

After that, in one year, the American College of Surgeons formulated its minimum standard for hospitals. Is there anything that a hospital can leave out of that standard and be a hospital? First, records; second, staffs, with staff meetings; third, a competent and honest staff; fourth, laboratories. That is practically the minimum standard of the American College of Surgeons. Any hospital that cannot furnish this minimum standard is not a hospital. It is the very minimum thing we could ask of hospitals to do in order to have us recognize them as hospitals.

That led immediately to a survey of the hospitals to ascertain which hospitals met this minimum standard. For the last three or four years surveyors employed by the College have visited all of the hospitals of one hundred or more beds in the United States and Canada.

SUMMARY OF YEARLY REPORTS

In 1918, of the 692 general hospitals of one hundred or more beds, in the United States and Canada, 89 met the standard; in 1919, 198; in 1920, 407, or 57 per cent; and this year 568, of a total of 761 hospitals, or 74 per cent, meet the standard of the College.

[1] Due to lack of space, the editor has taken the liberty of omitting portions of various addresses.

1921 REPORT

Today, we have the pleasure of presenting to you our annual report on the hospitals of North America, having one hundred or more beds. This list contains the names of such general hospitals in the United States and Canada as have met the minimum standard. In this list, a certain number of institutions are designated with a star. This group includes those hospitals which, when visited, had adopted the fundamental principles of the minimum standard, but which at that time had not had sufficient opportunity to develop all of them to a degree meriting the fullest approval. The hospitals listed without a star instituted these measures at an earlier date, and consequently received the benefits of a longer experience in the workings of the program and a broader conception of its application.

THE FUTURE PROGRAM

The program of the future will be extended to include all general hospitals of fifty or more beds in the United States and Canada. Of these institutions, many of which have been visited, a large number showed a working knowledge of the minimum standard and evinced an active desire to co-operate. The percentage of these meeting the standard on first visit compares favorably with the percentage of the larger hospitals approved on first inspection. If proof were needed of the universal application of the minimum standard, the acceptance by the smaller hospitals would furnish it. Stressing only broad fundamentals, the minimum standard molds itself to meet specific needs, nowhere impeding initiative or fettering judgment. Rightly conceived and carried out, it makes the hospital the proved guardian of the community health, rendering scientific service to all.

WHY THE COLLEGE MUST CONTINUE THIS SURVEY

Now, surgeons and hospital superintendents, what is the future program of hospital surveys other than I have indicated here? Why should the American College of Surgeons continue this work? It should continue the work because it is the measure that the College has of the fitness of the men who we expect will enter the College. It is impossible for the College to do anything but to take the leadership in the question of its own standard. It is something that we cannot delegate to someone else. Therefore, as long as the American College of Surgeons is in existence, I can see that it will be the duty of the American College of Surgeons—duty to itself—to see that the environment in which its candidates do their work is of the proper kind. Therefore, this work will have to go with the College. The success of this work, I believe you will all realize, lies in the fact that back of it is a great ideal for service and honesty. And this is the reason the program has succeeded far beyond our expectations.

HOSPITAL STANDARDIZATION FROM THE VIEWPOINT OF THE MEDICAL PROFESSION

By ROBERT L. DICKINSON, M.D., New York

MILD as this meeting looks, Mr. Chairman, it represents a revolution that has come very quickly and very sanely. Years ago Dr. Codman asked of the medical profession and of hospitals: "Do you dare show us your end-results?" A Dr. Martin takes up this challenge and with a Bowman and a Moulinier puts it into effect, and in working order, on a surgically sane basis. Hospitals have been answering that challenge ever since and their answer to the challenge represents the effect of hospital standardization.

Hospital standardization might belong to the American Hospital Association, that wonderfully able body represented here so fully. But standardization of the surgeon belongs to the surgeon.

Now, Codman saw years ago that you can have a surgical accounting as you can have any accounting. If it could be done in government, if it could be done in finance, it can be done here. Honor, honesty, and efficiency can be measured.

Let us come to the staff review. I take it the College—I am not speaking officially for them—I take it the College has had this to say: "Yes, we can give you a sample laboratory list, but as to what constitutes a staff review, you had better experiment a while yourselves. Start the machinery. Try it out." I think the time has come for the College to give us a sample procedure for staff meetings, adaptable to different types of hospitals.

One other pitfall: Here is a surgeon knowing that he should not have a mortality in his active service, we will say, of more than 4 per cent, and who therefore refuses to endanger his mortality record by certain operations. I do not want

any man to refuse to open my abdomen because he might exceed his death-rate. You have to have fearless surgery today.

Now, on the other hand, the reckless experimenter with human life must be curbed. Some of the greatest surgeons are the most reckless. How are we going to take counsel in any of these great things unless we do as Codman has told us to do? We should charge up an error of judgment or of technique when indicated and, in other cases, wipe that physician's record clean from censure who operates upon a patient *in extremis*, hoping to save a life. In other words, this matter of fair surgical mortality must be formulated and I think the College is the authority to act.

The hospital trustee comes to me and says: "You know my interest in this matter. What should our records be? What is a fair mortality? What is a fair infection in clean cases?" The College has given us certain averages. What would be a normal average? This is another place where the College might compile and publish interesting suggestions. In my opinion, the time has come to define a few other minimum standards.

Another point regarding the staff meeting: It should be for mutual stimulation and encouragement. Nothing is gained by turning it into a fault-finding clinic. We must bring in individual triumphs, as well as failures. Then the staff meeting will make for better effort.

When all is said and done, gentlemen, the whole story comes down to this: You cannot legislate these things. As the last speaker has said, the answer to all progress in medicine depends upon the elimination of the unfit, and the development of individual honor and competence.

THE HOSPITAL SURVEY OF THE COLLEGE IN 1921

By FREDERICK W. SLOBE, M.D., Chicago
Hospital Standardization Department, American College of Surgeons

IN January of this year, when the hospital program of the College for 1921 was evolved, it was decided to limit the survey to thirty months of hospital visiting. This was from necessity rather than from choice. Consequently, hospitals which were fully approved in 1920 were not revisited this year. Follow-up visits to these hospitals, however, were postponed only temporarily. Particular attention was directed toward those hospitals which either were not on the approved list last year or which were listed with an asterisk. In addition, as many as possible of the fifty-bed hospitals were visited also.

The survey was conducted through personal visits by a corps of seven hospital surveyors. These men—all physicians—were from medical schools and hospitals of widely separated sections of the country. They were given a course of training at the College headquarters, followed by survey work with experienced hospital visitors. This uniformity in training assured the College of uniform reports, which constitutes one of the essential features of the College program. Whether a hospital were in Maine, therefore, or in California, each institution was visited and surveyed on the same basis. Further, by visiting a large number of hospitals scattered over a wide range of territory, these surveyors obtained a general, rather than a local view-point. This policy of personal visits by relatively few, uniformly trained hospital surveyors is one of the most important elements of the College program.

There are certain difficulties experienced by hospitals in their endeavor to meet the standard of the College which merit special emphasis.

Relative to staff organization, one of the chief difficulties seems to be the adoption of a type of staff meeting which actually analyzes the clinical results. Slowness in developing a co-operative, group spirit among the physicians seems to be the chief hindrance. As this spirit develops, the purpose of the staff meeting becomes more nearly realized. In the average hospital a combined staff meeting is essential. Teaching hospitals, however, and other hospitals with highly specialized staffs, and hospitals having a staff membership of only one or two physicians, form certain exceptions to this rule. In such instances, departmental conferences, teaching clinics, and individual analyses take the place of the combined staff meeting.

The adoption of an official resolution prohibiting fee-division has been a second stumbling block in many hospitals. Hospitals which have been slow to respond may be divided into two groups. In the first group are institutions, in which, apparently, the practice has not been unknown and where, consequently, difficulty was expected. It was a distinct surprise, however, to meet opposition to passing such a resolution in

some hospitals of the second group, having a high ethical status in communities or sections of the country where the practice of fee-division is practically unknown. Some of these hospitals were very hesitant about passing resolutions condemning the practice. When they began to realize, however, that they served as powerful examples for other hospitals in which the practice was prevalent and that the College must apply a uniform policy toward all hospitals, they responded. That the viewpoint and stand of the College in this matter is amply warranted is evidenced by the impression gained by our hospital visitors, that the practice of fee-division is present to some extent in nearly every state and province, even though it may be practically unknown in some sections.

Case records are improving steadily although they still constitute the greatest difficulty in many hospitals. Two factors stand out most prominently in impeding the development of proper case-record systems in hospitals: first, the lack of proper interest in the case records by physicians and hospital executives themselves; second, the lack of internes. The first is just as important as the second, because even a full quota of internes without sufficient supervision will often fail to secure adequate records. When the hospitals do their share in supplying sufficient record facilities and personnel, and the staff members co-operate by exhibiting proper interest in supervising the records, most of the difficulties in this connection will be solved.

Laboratories have shown a similar steady improvement. There is a demand for laboratory equipment, technicians, and pathologists, which has been hitherto unknown. One handicap to the development of adequate laboratory service is the system of making a separate charge for each laboratory test performed. This difficulty has been obviated in many hospitals by establishing a flat-rate fee to include most of the usual laboratory tests. Tissue examinations should be included in this flat rate, otherwise it is difficult to obtain routine examination of all tissue removed at operation. Although the flat-rate fee may not be applicable in all hospitals and may be inadvisable in some, it has been of tremendous help to many hospitals in solving their laboratory problems.

Last year, out of the 704 hospitals in the United States and Canada having a capacity of more than one hundred beds, 407, or 57 per cent, were on the approved list. Of that number 193, or almost half, were listed with an asterisk.

This year, the total number of one-hundred-bed hospitals has grown to 761. Of this number 568, or 74 per cent, are on the list. Of these 568, 18 per cent, are listed with an asterisk, showing the great relative decrease in the number of hospitals listed with an asterisk this year. The asterisk has been used to indicate those institutions which, although they have instituted measures adopting the fundamental principles of the standard, have not developed them to their fullest efficiency at the present time.

Besides these larger hospitals, 704 of the fifty-bed hospitals were visited during the past 2 years. According to our records, there are about 875 of these hospitals, leaving about 150 which have not been visited. It is the hope of the College to visit all of these smaller hospitals next year, so that they may be included in the next approved list. The total number of hospitals visited by our hospital surveyors this year is 1,007.

The attaining of the minimum standard, of course, is not purported to be a resting place in the pathway of a hospital's progress. It is no ultimate standard. There are many things beyond. It does, however, contain the basic fundamentals and that, doubtless, is why so many hospitals have adopted it.

HOSPITAL STANDARDIZATION FROM THE VIEWPOINT OF THE HOSPITAL SUPERINTENDENT

By ALFRED K. HAYWOOD, M.D., Montreal
Superintendent, Montreal General Hospital; Representing Canada for the American Hospital Association

MODERN hospital administration has become a specialized profession within the past twenty years. Hospital administration today is not only a science, but a business. Those of us who have been hospital administrators for years realize that we are only at the beginning. Our hospitals stand for two purposes: they teach and they heal. It is not possible in every community that every hospital be a teaching hospital, but each one must be a healing hospital. If we hospital administrators are going to take our place in the community without a pretense, when we go out to financial men for aid, we must be in a position to show them the result of our work in black and white. We must prove by results that we are entitled to public confidence and support.

This procedure places a certain increase in expenditure on the hospital administrator. There was a time when we were quite content with a written report of an operation. But now we are not content with that. The majority of the reports are not legible. We must have a typewritten report. That means an extra stenographer and typewriter and extra equipment, and I can assure you that anything done to get 100 per cent of hospital standardization, as we have tried to do it, has meant increased expenditure to the hospital. But I can assure you, in addition to that, it has given us 500 per cent increase in results. A record for which we spent a thousand dollars a year was not worth 10 cents when 5 years went by, and we couldn't use it. Certainly the money we spent on records heretofore was absolutely useless. Now, we can get our records at any time and they are logical and contain every detail. We are considering putting in additional equipment and when the time comes that one of our surgeons seeks information we hope he may make use of it.

RECORDS—HOW LONG SHALL WE KEEP THEM?

This brings up the question, "How long shall we keep our records?" That has bothered a great many of the administrators of our hospitals. You cannot admit seven or ten thousand patients a year and keep a full record of all of them and expect to be able to house such records with the quarters that are available.

If our records are to be of the use they are expected to be, we cannot turn the patient out of the hospital without a very beautifully kept history. We turn our patient adrift as cured without the further knowledge at some late date whether or not the time and money spent on the cure of the patient will be lost. That consequently brings up the follow-up system. It is almost impossible for us to know that a patient has had proper treatment unless we use the follow-up system. And to conduct a follow-up system properly costs a great deal of money. As a rule that does not matter to the surgeon and to the attending men of the hospital.

The more a hospital administrator understands the difficulties of his attending staff, the more willing will he be to provide the staff with material or equipment to meet the hospital standard or for any other purpose that might be necessary. For that reason hospital standardization has indirectly brought the attending staff and the hospital administration much closer together.

STAFF MEETINGS

I think it has been conclusively proved that staff meetings properly run can be of immense benefit to the patient—to the patient first, because that is the ultimate object of our hospitals—and to the attending staff, second. How staff meetings are to be run is a question of opinion. One hospital superintendent says it is best to serve luncheon in conjunction with the meeting. When this is done fewer members leave the meeting for they hear things discussed with less loss of time. I have tried that plan myself and I find it has worked out wonderfully well.

If staff meetings are advantageous from the standpoint of our hospital administrators—and I am sure they are—and if staff meetings are a good thing for the attending staff and a success, why not let us have staff meetings for the rest of the hospital, for the matron of the training school, for the chief engineer, the housekeeper, the fireman? Why not have them meet and hear one another's troubles? They are all spokes of the same wheel, and I am convinced that the results of such meetings would be 100 per cent beneficial. There is no reason why the chief engineer, for instance, should not know something about what

is going on in the hospital. If such meetings are held, you will find that you have a spirit of cooperation among the workers, they work together, not against one another—a condition we used to see so often.

AUTOPSIES

Hospital administrators are anxious to have as many autopsies done in the hospital as possible. I think it is safe to say that the hospital administrator takes more personal interest in the securing of these autopsies in very many cases than the attending man.

Consent for postmortem examination can be secured, and I have been waiting for many a long day to have this opportunity to tell you just what we have been doing in the Montreal General Hospital. I am not doing it myself. I have nothing to do with it, but a member of my administrative staff has. Last year we secured permission for postmortem examination in 86 per cent of all deaths in the hospital, and this year to date we have secured permission in 87 per cent.

Hospital standardization brings to the administrator of the open hospital—I am not speaking on behalf of or against open hospitals—a controlling weapon over his attending staff. It does not necessarily need to be used as a weapon. But this much we do know that in open hospitals the work has not been of the same caliber as the work done in closed hospitals. The hospital administrator today in the open hospitals has in his hands with the aid of his committee of management a means, we will not call it a weapon, whereby he can come before his attending staff and tell them that they must meet the conditions contained in the minimum standard. He can say to them: "Yes, we will give you an open hospital, but in order to derive any benefit from this open hospital, you must meet our minimum standard."

HOSPITAL STANDARDIZATION FROM THE VIEWPOINT OF THE HOSPITAL TRUSTEES

By NEWTON E. DAVIS, D.D., Chicago
Executive Secretary, Conference Board of Hospitals and Homes of the Methodist Church

I COME to speak to you not from the standpoint of a trustee of a hospital but from the standpoint of the executive secretary of the Board of Hospitals and Homes of the Methodist Church which during the past year has had for its distinct service the program of standardizing its hospitals, making a survey of all the institutions within the bounds of the Board and seeking to find out the exact facts in relation to all of the work in our various institutions, especially of the church with which I am affiliated.

Up until a year and one-half ago, the hospitals operating under the Methodist Episcopal Church had no connection whatever one with the other. We had no Board. Since that time a Board has been organized, and the very first question that came before us for consideration was: "What standard shall we adopt and put into effect in regard to our hospital work?" There was only one answer to that—the minimum standard adopted by the American College of Surgeons. That is the best there is at the present time. Whenever we do see a better plan than that adopted by the American College of Surgeons, we shall add that to our already adopted program.

BOARDS OF TRUSTEES

In making a survey of our hospitals during the past year, 65 operating institutions, we have to begin back with the board of trustees, and we find some very interesting facts in our survey. Now, there are four kinds of boards of trustees, inasmuch as there are State institutions, municipal institutions, private institutions, memorial in character more or less, and also institutions operating within the bounds of some one of the denominations. So we have practically four kinds of boards of trustees. The State hospitals deal with their trustees through their State-appointed officers and trustees; the municipal hospitals, through officers and trustees appointed by the municipality; and the private hospitals are largely run by physicians with particular objectives in mind, memorial hospitals being private hospitals which have been built as memorials for families or for a group of people. We have different objectives in each group.

Now I will take up our own church hospitals. For instance, in an organized society, we have a body of men, the laity and missionary people, who want a hospital and want the church to get back of it. The important objective of any of these hospitals is the same, that is, that the patients shall have the very best kind of service rendered to them, from the diagnostic standpoint, the standpoint of treatment, or whatever it may be.

When we come to the standardization program, one of the first things that we find is that we have

to standardize a lot of boards of trustees. There are as many and varied kinds of ideas among boards of trustees as to what is the standardization program of the American College of Surgeons as there are among some other classes of folks who are non-medical practitioners. And we have had some very interesting sessions with men who for years have been president and secretary and treasurer of boards which have had very little to do with the hospital program. We have had this question asked many times: "Who are you? What does this mean anyway?" Most of them think it means expenditures of money, and it does. But without expenditure of money, we can never get to any place in the world. And I have been very frank to say to these members of our trustees: "You have run the institution on a cheap plan and you will have a cheap result." It means that you will have to expend more money and the best results cannot be secured without putting into it an adequate amount of money. And the boards of trustees of many of our institutions are very unconscious of the fact that none of our institutions can turn out the best product unless they provide conditions which are favorable.

CO-OPERATION OF TRUSTEES AND STAFF

So we face this problem. Many of our trustees have never been in close contact with the staff. They do not know what the staff wants to do. They do not know what a case record looks like. It is absolutely unreadable to them. And so you must educate the board of trustees to know what a really readable chart is and what kind of an analysis should be made in order that patients should have the very best means of diagnosis and the very best service rendered them.

FINANCIAL INTERESTS

Another feature directly concerns the Board of Trustees. They are tremendously interested in the financial interests of the hospital. I know one instance where a board of trustees had notes at the bank amounting to fifty-five or sixty thousand dollars, they were running behind in their current expenses, they did not know just how to meet them, or where they were going to get the money to buy all the equipment that the hospital was calling for. The proposition came up of a new staff organization in the hospital, which would entail the expenditure of an additional amount of money. Could they afford to add additional expense to the already great burdens in order to establish a standardized staff? And in organizing that standard staff, the plan was to determine and specialize the entire staff development. And the president of the Board of Trustees said frankly, after he had been in close contact with the chief of staff: "We cannot afford not to put in the additional equipment, to put in all the standard requirements, regardless of the extra expenditure of money that it does entail!"

Another instance: here is a hospital with a board of trustees which during the past years has not been making any reports to anybody. They have not been responsible to anybody. This board of trustees has been a unit in itself as a hospital, not making a report to any city or State. But somebody else comes along—the American College of Surgeons—and says to the surgeons of the staff: "You do not meet the requirements." A man from the outside steps in and says: "Can we see your hospital records? Can we examine your laboratories and equipment and see what you are doing?" If the surgeons and physicians in your community are to be held responsible for the results of their services in the institution, then the responsibility for that must come back to the board of trustees and also to the people outside who furnish the money to keep the institution going.

LAYMEN PLEASED WITH PROGRAM

We started in to adopt the whole program and the result has been that the boards of trustees are doing their duty toward their institutions and toward the community; whereas a year and a half ago they were letting the staff attend to responsibilities; today they have a larger view of their problem, and a more intelligent appreciation of the work that the institution is trying to do for the City, the State, and the Church.

There is one more word I want to bring to you. I believe that the body of laymen throughout the entire country are tremendously pleased with this great program. Why should they not be? As business men asking for the best results, they could do no better than adopt the program of the American College of Surgeons. A man can only sell something if he has it to sell. He cannot sell what he does not have in the shop. So the doctor who says, "I can do certain things," but cannot produce the goods does not last very long. We have had some non-medical practitioners who have said: "We will close your doors unless we can bring in our patients, regardless of your rules and regulations." The State can hold the board of trustees responsible to the State. They have not gone that far yet. But the State has a responsibility as to what the board of trustees

does, and the responsibility for every case that comes into the hospital comes back to the trustees in the end. If that is so, then the other truth is self-evident that no board of trustees can allow practitioners to come into the hospital who cannot give proper diagnosis or proper treatment or do proper service. They must meet the requirements. And I am sure I speak this morning for a very large number of people and a large number of institutions, and I am very glad, indeed, that the doctors of the American College of Surgeons have made up this program during the past 3 or 4 years and have established a standard. Dr. Martin has been the life-saver for hundreds of physicians.

In closing, so far as our own institutions are concerned, we intend to stand by this program and see that it is put into effect.

THE RELATION OF HOSPITAL STANDARDIZATION TO LABORATORY SERVICE

By JOHN M. BALDY, M.D., Philadelphia

DOCTOR Haywood, who spoke just before Dr. Davis, had a thought which I would combine with what I have to say and with what Dr. Davis has said. And that is the thought of a club over the medical men. I have never liked to admit that to myself but I have not seen it realized in hospital administration. That is exactly what it ought to have. There are enough men who need a little jogging. Can you hold a club over medical men? The whole question of hospital standardization is utterly hopeless if medical men cannot be whipped into shape to see that it is applied in every department.

The second thought is: The trustees lie down on the job, allow their names to be used and abused, and perhaps know nothing about their actual duties.

Now, as bearing on the laboratory and as far as the laboratory is germane to these thoughts, it is just this:

The boards of trustees have no better club, the boards of trustees have no better source of information, as regards the competency of their staff, as regards the earnestness and honesty of their staff. as regards the obedience of their staff to the rules and regulations of the hospital, than is furnished by the laboratory. Do these men in business take things for granted and receive no reports? I do not believe they do. They would not be the successful men they are if they did. And they would not be wanted by the people of the community to head their hospital organization because they are not getting reports of their business. Then why should they not ask to have systematic reports from the heads of this organization? If the board manager will say to the staff, to the superintendent, to the pathologist, etc., that every month he expects to have laid on his table reports of exactly what has been done in each department—so many tests for typhoid, etc.—and if in addition to that the name of the physician is placed opposite the number of the case, it will mean something. You will find that one man in the surgical department has asked for a hundred tests and another has asked for three. The first time that happens—very well, we call attention to the contrast. And the second time, it grows into a serious conference and the surgeon is told that this hospital board expects every man to do his duty; we do not like the looks of this contrast; this laboratory costs money, we have expended money on it; we want his record to show as well as Doctor Smith's—who has a hundred, while he has three; it must be corrected. And the third time: "We are sorry but we want your resignation." And you have to ask only one man on that hospital staff to resign. And if you want to get something out of your laboratory, the young man just out of college looking for a field is the man you can depend on. I would like to call attention to the fact that that is one prime duty of the pathologist, to check up you medical men, and that applies to all the medical staff. If he is a man of the proper caliber, if he is educated to the fact that that is part of his duty, if he is educated to have tact and not to lead his colleagues in the wrong way, they will be glad to have his counsel. He is there not as a technician. He is there as a consultant.

And I say to you boards of trustees by this system you can tell what every man can do. You have it in the laboratory, you have it in the record system. Every hospital should have an historian. I mean an employe, call him what you choose, whose prime duty is taking care of the records and rejecting absolutely every sheet that comes in improperly filled out.

THE STANDARDIZATION PROGRAM OF THE AMERICAN COLLEGE OF SURGEONS

By Rev. CHARLES B. MOULINIER, S.J., Milwaukee
President, Catholic Hospital Association

THIS is the first time I have been put down on the program to present the plan of the American College of Surgeons. And yet I think, during the three and a half or four years that I have been co-operating with the College, I have always been talking on that topic.

You have heard already what are the requirements of the standard. You have heard a great deal about organization of the staff, about the records, about the laboratories, and the division of fees, and about the autopsy work. I shall not go into any technical details because they have been set before you by those who have technical knowledge. I shall try to present to you, in as few words as possible, what seem to me to be the great historic facts of this movement for better hospitals—the scientific fact that underlies it, the ethical basis of it, and its bearing on the religious thought and feeling and spirit which is inevitable.

Historically, the Council on Medical Education began this movement for better hospitals when it began to make the medical schools better and when, following that wonderful movement, it began to look to the interests of the interne some 8 years ago. Some 5 or 6 years ago, the American College of Surgeons, stirred down into the depths of its soul, began to realize that it had a mission for the better care of the sick in the United States and Canada and made up its mind, as you all know and have been told, to improve surgery. But everybody also knows that you cannot improve surgery unless you improve everything that centers in the work of the hospital. And so the American College of Surgeons had not gone very far with its efforts and purpose to improve surgery when it realized that it had to improve everything in medicine.

Knowing that the Council on Medical Education had begun this work, the College, in its fine spirit of honor and regard for the professsion, went and said: "This is what we want to do; what are you going to do?" And the reply was: "Go on and do your work and we will stand by and help you." Therefore, you members of the American College of Surgeons, take it down deep into your hearts that you have been doing a wonderful work for the whole profession in bettering hospital service to the public.

That is the historic fact—absolutely unquestionable because I know it from personal experience in the movement from the very beginning, and hence I always take an occasion like this to say: "All honor to the American College of Surgeons." And furthermore, they are in the middle of the work. It is well begun. They have gone on, let us say, toward the middle of it and they must carry it on to the end, because they are the only body of people as far as I can judge, capable of finishing the movement, at least up to that point where it is sure and safe and sound and destined to go on. That is the historic point of view.

Scientifically, it seems to me that this should be said: The mind of the medical profession is being reached as it was never reached before, to make it more keen, more analytical, more cautious, and more co-operative in its scientific combination of thought, in its analysis of assembled facts, in its careful, gradual, step-by-step arrival at a diagnosis. And this grows out of the organized staff. This grows out of the monthly staff meeting, or weekly departmental meeting, as the case may be. It has brought about that the medical profession working in the hospital has come to the conclusion that minds must get together, that facts must be assembled, and the right analysis of those facts arrived at either by the individual, a small group, or the whole staff. In other words, gentlemen, without intending it, as I observed throughout the continent, the medical mind is being convinced by this program of yours that the time for independent and separate and distinct and hostile personal thinking is past in medicine. Today everybody is convinced that no medical thought is finally safe for the patient, for the public, until several minds have agreed. Standardization, therefore, in as far as it means organization of staff, in as far as it means monthly conferences, has meant a great development of the medical mind throughout the country, and, above all, a great development of medical character. Men today, instead of being distinct individuals, are growing into the greater stature of men working with their fellows, an embodiment of much greater capacity and character communicated into action.

Just one more word about these monthly conferences. I believe there is an incomplete ap-

preciation of what they mean. The College speaks of them as clinical conferences, as investigating the clinical experiences of the hospital. But the College does not say, except impliedly, that in these monthly conferences lies the secret of the success of the whole movement. Your records will not amount in value to the paper they are written on, your laboratories will be useless, you will get no autopsies worth while, the unjust division of fees will go on, unless your monthly conferences are genuinely, are sincerely, are absolutely high-minded and get down into the very heart and soul of every man. Because, gentlemen, what is the monthly conference? It is a review of what was done at the whole institution for every patient that came into the hospital. I do not care how many statistics you have, how correct they are, the facts in figures are without the scientific soul of the facts, unless the soul of the medical man is big enough to analyze those facts. Thirteen deaths in the past month means nothing. Why did each one die? So many unimproved in the hospital means nothing. Why are they unimproved? What has been the use of the laboratory? Why haven't we had more autopsies? Gentlemen, it is hard, it just tears the soul out of a medical man to have to face his own failures, his own incomplete work, his own missing of diagnosis, his own failure to have consultation when he should have had it, his own incapacity to assemble the great facts involved in the case and then miss in his diagnosis or fail in his operation or somewhere in his treatment. They call it a minimum. I call it a fundamental.

And here let me make a plea, such as was made here on the stand this morning, for the young man, for the man that wants to grow. Let the older men play the big brother. Let them be the outstanding leaders, not so much in what they know or in their skill but in their greatness of character, in their readiness to say, "I don't know, I failed, help me."

Now, just one more word on that question of the monthly meeting. The American College of Surgeons has a mission. There is an apostleship for them to take. They have not been brave enough. They have not been aggressive enough. They have not in all cases set the great example of genuineness in these monthly meetings. Those monthly meetings cannot be like the County medical meetings or those of any special association and at the same time attend to the business of the monthly meeting. What has been done for our patients? Where have we failed? Where have we succeeded? Papers, discussions, cases are not the real thing in those meetings. There is no intention on the part of the College to displace County medical meetings, to displace the work of your specialist society, which is all one thing. What has this hospital, from top to bottom, from engineer to superintendent, including the nurses, the orderlies, and everybody—what have we done for our patients during the past week or month?

The College started with the thought of bettering surgery. They are in the midst of bettering the whole practice of medicine. Why? Because the heart of the movement, the heart of the record, the heart of the monthly meeting, the heart of the service in the laboratory—I mean scientific heart and ethical heart—is diagnosis. It all centers on diagnosis; no hurried, no snapshot, yet no elaborate (beyond human frailty) diagnosis, but a genuine, sincere, a definite, direct, cautiously and deliberately arrived at diagnosis of what is the matter with the patient. That is the heart and soul of medicine.

Here again I would like to say a word of commendation, a word of praise, a word of congratulation to the members of the American College of Surgeons throughout the country for the thoughtful, the really scientific, and the deeply conscientious way in which they are going at this program. There is no doubt about it, gentlemen, if I am at all safe in my conclusion on the reading of medical history, that there has never occurred a movement equal to it in the past history of our race. Here we have a great body of men on a great continent—and it is sure to reach the rest of the world—facing a tremendous ethical responsibility by a keen administration that is scientific of the laws of health. It is done because you all, down deep in your hearts—and particularly is it true of the hearts and minds of those men who have led the movement, Dr. Franklin Martin, Dr. John Bowman, and others in the office who have led the movement—feel that it is the greatest in the history of medicine.

If I may be allowed just a few more words: At the first meeting you had in Chicago, when you began this plan, I was fortunate enough to be asked to address you. There were there three hundred members of the American College of Surgeons and the title of the program was "Hospital Standardization." And I can recall with a great deal of vividness that at the end of the morning program I arose and I said: "Gentlemen of the American College of Surgeons, your title may be all right but I am going to be bold enough to say to you that it means not primarily standardization of hospitals but it means the standardization of the medical profession, in mind, in character, and in heart."

REPORT OF RECOMMENDATIONS OF THE AMERICAN RAILWAY ASSOCIATION IN CONNECTION WITH HOSPITAL STANDARDIZATION

By DANIEL Z. DUNOTT, M.D., Baltimore
Chairman, Medical and Surgical Section, American Railway Association

I HAVE been requested to speak to you this morning on what the railroads have been doing in connection with this program of standardization. And in order that you may form some idea and reach some conclusion as to just what we will be able to do to assist in this movement, I think it might be well to spend a minute or two on the question of what the organization is that I am speaking for.

The American Railway Association is an organization made up of the presidents and managers and operating officials of the various railroads throughout the country that are members of this Association. The Association membership comprises about two hundred and eighty-four thousand miles of railroad in the United States and Canada, and you will therefore see that practically every railroad in the country is a member of this Association.

The Association itself is conducted in the following manner: It has its own president and its general secretaries and secretaries of sections. The operating officials of the American Railway Association, the men who pass upon the recommendations made by the various sections of the Railway Association, are the general managers and the president and vice-president of the railroad, and while the action of the American Railway Association itself is not compulsory or mandatory, it becomes a forceful action as a recommendatory practice because the very men who are called upon to accept the recommendation of the American Railway Association are the men who have favored such action.

The American Railway Association has numerous sections. It is needless for me to go into details in regard to them. Our section is the medical and surgical section and this section comprises, or is made up of, the railway and surgical chiefs of these various railroads that are members of the Association. This section was first incorporated in the American Railway Association about a year ago. And one of the first actions of the committee of that section was to take up the question of hospital standardization, because the railroads felt that it was imperative that our employes injured in service must get all possible care and attention.

The committee on hospital standardization discussing this subject made the following recommendation through its chairman, Dr. A. F. Jonas, of the Union Pacific Railroad:

"The medical and surgical section committee on hospital standardization held a meeting at Chicago on April 6, 1921. In accordance with its understanding of its purpose, it has adopted the minimum standard as the basic recommendations for the railroads of the Association."

The recommendation of the committee was accepted and it was submitted to the various members of the sections, who unanimously approved it and on the sixteenth of November it will be submitted to the annual session of the American Railway Association, and I have no doubt in the world will be approved.

Now, this will mean that the railroads through their surgical service will take the position that they will have their men treated in hospitals that meet with the minimum standard of the American College of Surgeons. You appreciate as well as I that a large amount of our work is of an emergency character and that, therefore, we cannot always be choosers. There will be times when we will have to put men in a hospital that has not adopted the minimum standard for hospitals. But it is our intention wherever it is practicable to remove those patients from such hospitals and put them in a hospital having the minimum standard just as soon as consistent with safety to the patient. I do not know but what it is a pretty good thing to follow that up even a little bit closer than that. I am sure that in a number of instances the transportation of a man seriously injured—crushed leg, we will say—for a greater distance to a better hospital would be giving that man a greater opportunity for recovery than putting him in a hospital that was not up to the standard in its work.

GREAT IMPULSE TO STANDARDIZATION MOVEMENT

We have in the railroads about thirteen thousand doctors and students acting in the capacity of surgeons for the railroads. And we have about 275 or 280 men who are members of

surgical staffs. And with the railroads taking this position, I believe that it will be a tremendous factor in assisting the bringing of standardization over a larger field.

I cannot give you the exact or even the approximate number of hospitals that are used by the railroads. I hoped to be able to get that but I could not. I know that the Baltimore and Ohio uses about 310. The Pennsylvania railroad uses about 277 hospitals. The Union Pacific, on the other hand, a railroad of about nine thousand miles, or three thousand four hundred miles larger than the Baltimore and Ohio, uses only about 123. The Union Pacific has 20 hospitals that are under its own control, at least that they contract with. The other hospitals are hospitals that they have used from time to time in emergency.

The railroads use four-fifths of the hospitals of the country, and while of course a large number of the hospitals have already reached the minimum, still there is a very large field which will be affected by this position of ours, and I can assure you the doctors of the American Railway Association are going to take the position not verbally but actively.

THE INDUSTRIAL HOSPITAL

By EDWARD MARTIN, M.D., Philadelphia
Commissioner of Health, State of Pennsylvania

SHORTLY after our last election in Pennsylvania, in talking with the attorney-general, I said: "The woman's vote has not been conspicuous for its power." And his reply was, "Doctor, there ain't no such animal as the woman's vote." And so in regard to the industrial hospital.

With some exceptions in some localities and in some businesses, I think, and my belief is, that there "ain't", or should not be, such an animal as an industrial hospital. The problems of industry are the problems of civil life.

We see much of special courses in industrial surgery. The basis of industrial surgery is the fundamental medical education, a long training under the eye of an expert, and that training that fits men for surgery in general.

Each industry has its particular form of accidents and each industry must have special experience in that line, and a school of industrial surgery cannot be established in Louisiana, Pennsylvania, or even in Massachusetts, but must be based on that sound, fundamental, surgical knowledge acquired by elbowing or being with a master of his craft and then further knowledge in the individual industry concerned.

And the same holds true, since we are speaking of hospitals, on the medical side.

The answer to industrial surgery would seem to be comparatively simple. There are some people who are obsessed, who are possessed, who are enthusiastic, who are—we will say—crazy, in certain directions. They are the people who lead the progress of the world. Who of you, going back to your school days, going back to your graduating period, who of you would accept any full-time position with no opportunity of rising beyond the high-school course? Who of you would want to lose his ambition and serve an industry on a given annual sum for which they assume the entire responsibility in their hospitals and care for the people of that industry? That is a check strap to all future progress. So that seems to be the simple answer, "There ain't no such animal as an industrial hospital." There "ain't no such animal" as an industrial surgeon. It belongs to the best of the profession to guide and train those who are coming on.

THE INDUSTRIAL DISPENSARY

By F. L. RECTOR, M.D., New York
Secretary, Conference Board of Physicians in Industry

THE industrial dispensary need not have the equipment or personnel of a hospital unless it is remotely situated. The average industrial plant is in or near a community with hospital facilities. The care of minor injuries is all that should be attempted in the routine work of such a dispensary, major work being sent to the larger and better equipped general hospital. In those cases where the industry is remotely situated it will be necessary to provide more ample hospital facilities; but in these cases the general hospital becomes more of a community institution for the workers and their families in cases of injury or severe illness, while the smaller

and more convenient dispensaries for treatment of minor cases are placed in the plant itself.

Dr. Clark of the Norton Company believes, and others agree, that it is necessary from the standpoint of economy and production that no employee should be ordinarily over 15 minutes from a dressing station. In a scattered organization this need can be met by having branch dispensaries in charge of nurses placed at strategic points throughout the work for the first care of injured workers, the physician being on call at the main dispensary and in addition having regular office hours at each branch dispensary. By this means a maximum service can be supplied to workers.

Just a word about records in the industrial dispensary. A fairly representative experience in the inspection of industrial dispensaries has shown that those who keep adequate and intelligent records are in the minority. I have found record forms varying from a blank 3 by 5 library card to a form 10 by 12 inches in size, both sides of which were filled with information about the worker. Many industrial dispensaries religiously collect records and just as religiously file them away without any attempt at analysis.

The proper use of such records can be of great assistance to the production department, as many times the information that they contain will bring to light causes of retarded production that would otherwise escape recognition. Such records often indicate the health standing of the home and community and will enable the plant physican to be of material assistance to the work of the public health authorities.

The physical examination of industrial workers is made of greater value by a proper record system. One important point is frequently overlooked in this work. Some physicians insist upon a very detailed record of the examination of every person, thereby consuming valuable time without an adequate return to the employer or employee. In this connection this fact should be kept in mind: there is a big difference in the physical examination of the industrial worker and the hospital patient. In the case of the worker we are dealing with an individual who is well or thinks he is well, and who is being examined for a specific purpose, namely, his ability to perform certain kinds of work. Only those conditions which have a bearing upon his employment are of immediate interest to the examiner. In the other case the hospital patient is sick or thinks he is sick and the examiner is justified in going to extreme lengths if necessary in order to find out the true condition of the patient.

The earnest effort of most of the physicians in industry to utilize the services of all who apply, even though some may be defective, is doing much to break down the opposition to physical examinations that has existed on the part of some workers and particularly the labor organizations. The Conference Board of Physicians in Industry has formulated the principle that, provided there are positions to be filled, employment should be denied no one unless, when employed, he becomes a danger to himself, to others, or to property.

As to staff organization in the industrial dispensary, I found in a recent survey of over 200 plants, that in 101 establishments with one or more full-time physicians, there was an average of one physician to each 3,083 workers. Please keep in mind that the figures just quoted are *averages* only. In any given case the staff organization required will depend not so much upon the number of employees to be served as it will upon the character of the industry and the different functions delegated to the medical department.

Another important consideration of the work of the physician in industry, and of the value of the industrial dispensary to the workers, is that of the administrative responsibility of the head of the medical department. In visiting nearly 100 industrial plants in New England last year it was found that in only 39 was the medical department under the direct supervision of an executive of the rank of works manager or above; while in 44 other plants the responsibility was to the employment manager, industrial relations superintendent, or other subordinate official.

In the survey of 207 plants just referred to, which covered more generally the larger industrial sections of the country, the same conditions were found to exist. In 108 plants the works manager or a higher executive supervised the medical work, while in 95 plants this work was under the person in charge of industrial relations, safety, employment or compensation, office manager, or other subordinate. Obviously the work of a department of the importance of the dispensary should be accorded the standing of other major divisions of an industrial establishment.

Discussion on Industrial Hospitals and Dispensaries

John B. Lowman, Johstown, Pennsylvania: It has been my privilege to be connected with, I think, perhaps the best industrial hospital that was ever built in the United States, forty years ago. At that time, as you know, the corporations did not realize what benefit they would derive from taking care of their own sick and wounded. Through my father, the Cambria Steel Company was induced to build a small hospital for the care of the sick and wounded. They appropriated the sum of ten thousand dollars for this hospital and founded ten beds. It was very hard at first to get any patients into this hospital establishment. But finally, after a certain length of time, the usefulness of it was discovered by the corporation and that hospital has been increased from that time on, until last year they built a new hospital costing about eight hundred thousand dollars. That simply meant the advisability of taking care of the sick and wounded not only from the humanitarian standpoint but also from the financial standpoint.

William O'Neill Sherman, M.D., Chief Surgeon, Carnegie Steel Company, Pittsburgh: During the war, fifty thousand two hundred and eighty soldiers were killed. During that same period, there were one hundred and twenty-five thousand accidental deaths in this country. Thirty-five thousand were killed in industries. Seventy-one thousand were killed outside of industries. Of this number twenty-five thousand children under the age of twelve were killed. There were two million injured, the disability lasting one month or more. And basing our statistics on the monthly disabilities, I would say there are twelve or fifteen million minor injuries of a disability of less than one month. In Pennsylvania in 5 years there were fourteen thousand two hundred and forty-two fatalities, three hundred and twenty-seven thousand serious and six hundred and fifty-three thousand minor injuries, making a total of approximately one million accidents in the State of Pennsylvania within 5 years, or seven hundred each working day. There were fifty-one thousand accidental and violent deaths in Allegheny County between the years of 1903 and 1920, inclusive. The compensation costs in this State, for the killed and injured in these 4 years, amounted to forty-eight and a quarter million dollars. The statistics of the New York Compensation Commission show that 33 per cent of the cases coming up for compensation adjustment require further reconstructive surgery. In other words, the general surgeon's or the general practitioner's work has to be reviewed and referred to an orthopedist or some one else who is doing his reconstructive work. That is an indictment of the character of work that has been done by the general practitioner. A speaker of the State Compensation Commission some few years ago referred to the fact that in approximately 35 per cent of the cases of application for compensation there was evidence of infection. That is another indictment against our general surgeons and general practitioners.

While some are still crying: "Why standardize every hospital"? we would say, "The American College of Surgeons should standardize the equipment and should standardize the methods of treatment."

Some of our failures have been due to neglect in therapeutics. We have absolutely neglected electro-, mechano-physical, and hydro-therapeutics. I have it from very good authority, a gentleman who has visited every hospital in the country, that there are very few of the hospitals which are equipped along these lines. And as the result, we are driving the people into osteopathy and to the chiropractor. We are responsible for it.

The American College of Surgeons Should Standardize Industrial Hospitals

There is no question, gentlemen, that the American College of Surgeons is the institution through which a higher and more scientific work can and should be introduced into the industries of this country, and that embraces necessarily the railroads and all of the great industries of our land.

I do not mean that they should have a policy of "You must do so and so," but a policy of this kind, that "Upon investigation, we believe that this or that method has brought about the best results." And in this way the industries having hospitals would whenever possible introduce standard methods.

General Discussion

Mr. Daniel D. Test, Superintendent Pennsylvania Hospital, Philadelphia: I want to congratulate the College of Surgeons on its program of standardization, and the splendid progress it has made. Hospital standardization means the standardizing of the personnel as well as hospital equipment and practice. This means managers, doctors, and executives, and all must have a share in the work. Until we seek to standardize ourselves, our efforts to standardize our hospitals will be feeble.

So long as managers fail to recognize that sound hospital management rests upon fundamental principles which have been established by experience; so long as doctors insist on policies that their colleagues do not want or approve; so long as superintendents try to make rules for everything, and then think that their rules are as sacred as the laws of the Medes and Persians, just so long will hospital standardization be impossible and hospital work be inefficient.

The old idea of each group being suspicious of, and antagonistic to, the others must give way to a co-operative partnership which will co-ordinate all the efforts which the hospital makes. If this result is attained, the doctors and superintendents through their organizations must talk and work for sane standardization, and we must seek to impress upon managers the necessity for their joining heartily in the work, with a view to standardizing themselves as well as their subordinates—the doctors and the superintendents.

The progress which the College has made since its meeting in Chicago 4 years ago should give us fresh inspiration for further effort. Two days were given to standardization at that time. When I think of the first day and a half of that meeting I am reminded of how I was impressed with the great need for standardization among the physicians present. During this time one doctor after another spoke of the importance of standardization, but before closing his remarks every one said in effect that nothing must prevent the doctor from having everything he wants and just when he wants it. I was wondering how standardization was going to have a chance when on the afternoon of the second day a doctor began his remarks by saying: "It is about time we were turning from the consideration of what we want, to the consideration of what we ought to have, with due regard for the other departments of the hospital." This entirely changed the key-note of the meeting, and seems to have set a standard for us all.

I do not speak of this in a critical spirit; but merely to show the progress that has been made. The attitude at the time was perfectly natural. None of us had thought the matter through. We were still living under the old dispensation of hospital work. The new dispensation of co-operation has dawned, and the College of Surgeons has sounded the first call.

Mr. John Smith, Superintendent, Hahnemann Hospital, Philadelphia: In the 3 or 4 years that the American College of Surgeons' standard of diagnosis and records has been in progress, we can see a wonderful improvement in the treatment that the patient gets, the treatment he gets immediately after admission, the preliminary history, and the laboratory privileges, and throughout this whole program we have become more careful, and the patients themselves have received a wonderful benefit from it.

George O'Hanlon, M.D., Superintendent, Bellevue and Allied Hospitals, New York: The program has been most interesting and most helpful, not only to those that have already met the standard during the past 3 or 4 years but to those who are still "without the faith." I am very sure that after this meeting the trustees, the attending staff, and everybody connected with the hospital will make it their individual and combined effort to meet the requirements. They are so simple although in some cases expensive. They can without any difficulty be met.

I happen to be connected with five hospitals, all of them teaching institutions, with one exception. When the standardization of hospitals was introduced, we met the requirements. They are City institutions, maintained at the expense of the City of New York.

In passing, I might just tell you—those who are unacquainted with hospital organization in New York—that the general hospitals of Manhattan are under a board of trustees. The public hospitals of Brooklyn, Staten Island, and Blackwells Island are under the commissioner of public welfare. The commissioner of public welfare took the lead, 2 or 3 years ago, and issued a general order applying to each and every hospital of the Department, directing the staffs to comply with the minimum standard.

For several years it has been our practice to have not only the regular staff meetings and attendant staff meeting, but the administrative staff meet at least once each week; the superintendents, assistant superintendents, superintendents of nurses, purchasing agents, doc-

tors, and all the people who were recognized as heads of departments are called together each Saturday morning. The general affairs of the institution or of the department are taken up and discussed, so that each person knows the difficulties that we have to contend with, whether it is difficulties with the attending staff, difficulties in the operating room, difficulties in getting money from the City Fathers, changes in the personnel, changes in the pay-roll, and even the question of infection in the wards. The superintendents and pathologists of each of our hospitals attend all meetings of the board and present a report of the work that has been done at each hospital and the sources from which these reports come, so that it is apparent who makes use of the laboratory and who does not, and the amount of increased interest and care shown. A few weeks ago at one of the hospitals complaint was made that the laboratory service was not satisfactory and the pathologist was not present to report. So the next meeting we asked him to attend and give in detail the amount of work he was doing and the sources from which those requests came. During the preceding month, the hospital, with perhaps four hundred admissions, and a very active service, made requests for two blood counts. I think six autopsies had been performed. They asked why he did not do more. He said no one asked for more; that he had on one or two occasions gone into the wards to learn something about the cases, and it was made very apparent to him that he was not welcome; so that he had profited by that experience and lost his interest. And as the result of that conference, the staff are making much more use of the laboratory.

GENERAL SUMMARY OF HOSPITAL STANDARDIZATION AS INAUGURATED BY THE AMERICAN COLLEGE OF SURGEONS

By MALCOLM T. MacEACHERN, M.D., C.M., Vancouver
Superintendent, Vancouver General Hospital

SUMMARIZING hospital standardization, as inaugurated by the American College of Surgeons: You have come here with set opinions, you have gained new opinions, your old opinions have been intensified by this wonderful meeting today. But how are we to think of this hospital standardization meeting? What is your psychological reaction? You have been impressed with the fact that this movement pleases all.

Now, one or two thoughts: First of all, because of the better working out of the cases in the hospital, because of better diagnoses, because of more intelligently applied treatment, because of the staff review conference work, what are your hospitals showing statistically? If we were prepared to present complete statistics today, they would absolutely run like this: lower death rate; reduced number of operations; fewer postoperative infections and complications; and lastly a lessened patient's days' stay in the hospital. We have some statistics already showing this conclusively, which may be mentioned at the round table this afternoon.

The second thought: This movement has created a deep sense of responsibility in our so-called hospital groups in the care of the sick, whether in the hospital or outside. First of all, the administrative side of the hospital has been affected as you have been told today. The staff of the hospital has become more conscientious to its duty. Second, the medical men have been impressed by the movement and are trying to mold their ways to produce better and more scientific results. Thirdly, the boards of trustees are realizing their responsibility. They are realizing, indeed, that they must have two reports: first, a financial report; and second, this report, what I could call the physical report of the hospital, showing the physical assets and liabilities. And the assets are: patients discharged well and improved. The liabilities are: deaths, unimproved cases, infections, and complications. And from these they make their balance sheet.

The next thought: what are the people thinking about this? Before they go in for treatment the people are now asking what hospitals are meeting this required standard.

This program that you have heard today surely has impressed you with the fact that it has carried a message of better service in the hospitals of both countries and hundreds and hundreds of thousands of patients, now and later, must surely benefit by it.

Lastly, how does it affect the nation? It is one of our great economic questions, because it means that by hospital standardization there are fewer deaths, there is less cost to the hospital in the care of the patient from fewer complications and infections, and finally there is a shortened days' stay in the hospital, which means, as the industrial representatives have told you, putting the patient back to producing capacity sooner.

AFTERNOON SESSION—ROUND TABLE CONFERENCE

HOW HOSPITAL STANDARDIZATION CAN IMPROVE THE PROFESSIONAL WORK AND THE SERVICE TO THE PATIENT IN THE HOSPITAL

CONDUCTED BY MALCOLM T. MACEACHERN, M.D., C.M., VANCOUVER
Superintendent, Vancouver General Hospital

DR. M. T. MACEACHERN: Before starting the Round Table, I want to mention seven points which I think are stimulating at this time in order that we may give better service in the hospital to the patient, and it may in a way summarize the work.

First, giving to the patient upon admission a good reception so as to put the patient in a comfortable mental attitude toward the hospital and the staff, so that the patient will react more favorably to treatment.

Second, prompt attention at all times to the patients' needs, whether large or small.

Third, competent examination of the patient, with a carefull record of the same; a careful record of everything concerning the patient while in the hospital.

Fourth, availability and utilization of all the diagnostic and therapeutic facilities necessary in making a good diagnosis and carrying out effectually applied treatment. Get the two points—first, all the facilities for a good diagnosis, and second, all of the facilities for effectually applied treatment.

Fifth, consultations between your staff; consultations between the staff and the administration; consultations both scientific and administrative.

Sixth, careful analysis of the work that you heard so splendidly put to you this morning in the staff conference, and, Seventh, intelligent monthly reports to the board of trustees.

Now, this means better diagnosis of your patient, better application of the treatment, and return of the patient to producing capacity as quickly as possible in the most efficient and most comfortable manner. That is what your patient expects of you as hospital administrators and as surgeons and physicians. That is what the public, as the financial support of your hospital, expects. Just as in a factory, putting out a certain product, so our product here is health, which must be of the highest standard. Now, these services which concern us chiefly today are scientific services of the hospital, for which we can set no limit.

SECTION A—STAFF ORGANIZATION

1. *Many hospitals find difficulty in formulating staff by-laws, rules, and regulations for the guidance of the professional work therein. How can the College give them greater assistance? Can they secure a set of standard by-laws, rules, and regulations setting forth the principles involved which shall guide them in drafting their own?*

DR. FREDERICK W. SLOBE, Chicago: There have been many changes in the general policy and system of the staff rules and regulations during the past 5 years. Originally, the constitution of hospitals embodied general principles of organization chiefly, and contained practically no details relative to the clinical management of the hospital. During the last 5 years, however, as a result of the great emphasis placed upon staff meetings and staff organization, case records, and laboratory facilities, in the standardization campaign, there has been great emphasis placed upon certain rules which would carry into effect the principles of the minimum standard.

Of course, there is no one standard set of staff rules and regulations which can be applied to all hospitals. Naturally, a hospital of fifty beds in a small community cannot use the same constitution and by-laws which would be applicable to a large hospital in a metropolitan center. Therefore, the College advises certain broad principles only, leaving the detailed application of these principles to the various individual hospitals themselves. There are certain general rules, however, which have been incorporated in practically all of the rules and regulations. Many of these are so elementary that they may seem entirely unnecessary to some of you who have been associated with larger hospitals in the larger centers. I can assure you, however, that these same rules are almost revolutionary in a great many hospitals scattered over the country. I will mention just a few of these rules which have been adopted and incorporated into the by-laws of various hospitals.

1. That the staff conference include a careful analysis of the results obtained in the hospital during each preceding month.

2. That regular attendance at staff meetings be insisted upon, attendance being expected of all physicians who have had patients in the hospital during the preceding month.

3. That the physicians afforded the privileges of the hospital abide by its regulations and that the practice of fee-division be absolutely prohibited.

4. That the case records be written within 36 hours after admission.

5. That a history, physical examination record, and pre-operative diagnosis be recorded before operation (except in emergencies).

6. That no case record be filed until it is complete.

7. That every specimen removed at operation be sent to the pathological laboratory for a report.

8. That a system of laboratory charges be worked out which will allow every patient to receive adequate laboratory service.

These rules are general and neither impede the initiative of any of the staff members nor hamper individual judgment. The announcement of a definite policy of this kind by a hospital is an expression of its endeavor to live up to its responsibility to the community.

At the College headquarters we have various samples of staff rules and regulations adopted by hospitals in their endeavor to meet the standard. We will gladly send out these samples to any one interested.

2. *Many hospitals require the attending doctors to sign a pledge or card, the latter often being known as the "Physicians' Registration Card." Has this been found beneficial? What is the best form to use?*

DR. FREDERICK W. SLOBE, Chicago: In order that the physicians may clearly understand a hospital's policy, it has become quite customary for hospitals to obtain the physicians' signatures to the constitution and by-laws. In other instances individual declarations are drawn up, stipulating an agreement to abide by the rules and regulations of the hospital and a pledge against the practice of fee-division. In still other instances, an individual fee-splitting pledge is the only form used. Cards are sometimes used to serve the same purpose.

This procedure on the part of the hospital should not be viewed as derogatory to its staff members. Instead, it is a means of demonstrating to the community the hospital's endeavor to uphold a high standard of medical ethics and practice.

The College has some of the forms which are used by the various hospitals in this connection and will gladly send them to any one on request.

DR. E. R. SECORD, Brantford, Ontario: Just to provoke a little discussion, I will say that we have no cards, no pledges, and as far as I am personally concerned, I am of the belief that he who desires to split fees or otherwise act in a way contrary to the standards that we believe to be proper will not be bound in any way by any mere signature attached to constitution and by-laws, cards, pledges or anything else of the kind.

A MEMBER: The signature to the by-laws and rules and regulations, as mentioned by Dr. Slobe, will have a moral effect on the professional bodies of the hospital.

3. *In certain instances the attending doctors of hospitals have been found lacking in clinical interest. What can be done to stimulate more interest in such cases?*

DR. H. J. MOSS, Brooklyn: The question that we are discussing now seems almost unnecessary. After reviewing the work of standardization of the American College of Surgeons this morning, whereby each surgeon is expected to do the right thing by the patient in the matter of keeping records, it seems to me that this answer takes care of itself.

In the first place, your staff should be appointed only for the period of a year and at the end of the year re-appointments should be made upon the work that each and every member of the staff did during the year. If a record or inventory is kept during each month of the year, it becomes a very easy matter at the end of the year to take a gross inventory of the twelve months and find out what the particular surgeon has done during that given year. You have then, at the end of the year, your whole record of the total of infections, the number of deaths, of that particular surgeon.

In other words you have an absolute inventory of everything that the man has done during the year. Then if he has fallen short of the requirements, that particular man should not be re-appointed.

If you adopt that rule, I think you will not have to be concerned about the interest that each individual doctor shall take in his individual work.

A MEMBER: I have found in hospitals the best clinical stimulus is the staff conference. In the

modern hospital the material that is discussed at staff meetings is a great stimulus.

4. *How often should the staff conference be held and what is the best form for it to take, a luncheon, a dinner or an evening meeting? What should constitute the agenda for such a meeting?*

DR. FRANK J. JENNINGS, Brooklyn: As to the frequency of staff conferences, we feel that that is largely a local matter. Hospitals and staffs vary. In the average general hospital which has on its staff a good many general practitioners, we feel that a meeting held once a month is to be preferred, and that it should be a convenient meeting, the later in the evening the better, subject to certain limitations. I do not mean to hold it at midnight, but at 9 or 9:30, so that the man in general practice who has evening office hours has a chance to take care of his office or to make a call or two if he has to make it, and get to the staff conference.

In a small, closely controlled staff, the weekly meeting is a splendid meeting; as, for example, at the Woman's Hospital at New York under the direction of Dr. George Gray Ward. When a hospital is starting staff conferences and perhaps has friction or factional feeling to eradicate, a lunch or dinner may be the means of expediting or facilitating the starting of the conference.

Now, as to the "agenda." For the successful formation of the staff conference, you must have a ritual if you are going to succeed. Doctors do not vary much in temperament or character all over the country, and they have not quite reached the point of beginning a staff conference. So the first thing that we believe is practicable is to form a staff conference committee. This is composed of three members, representing the different services in the hospital. It is very essential to have as chairman of that committee a level-headed man who is a good presiding officer.

In the development of conferences, the first thing that is a matter of attack is the record. You have heard described this morning and also this afternoon by Dr. Slobe what a good record should contain. There is no necessity for my going into that, but you will find that through staff conferences your records will steadily improve. At our last staff conference held at St. Catherine's, I think the strongest impression any one would take away was the high quality and excellence of our records.

Mortality we believe is properly a subject for review. The records of those who have died are looked over and those which may point a lesson in any way are selected. The man who is responsible for the case, abstracts the record and reports it. Now, that has a didactic value which to me is beyond criticism. At the last conference a death from incision and drainage of an abscess of the thigh, secondary to osteomyelitis of the femur, was reported. Just to show you the value of that particular report: the patient had taken a general anæsthetic and had gone through a forty-minute operation when her actual surgical capacity should have reminded the surgeon to keep her in bed and to make a small incision only. The lesson conveyed to them was that they should be on the lookout to see that they did not go beyond the limit of the patient's surgical endurance. And you can multiply that *ad infinitum* with consequent good, first of all to your staff, and, of course, always to the patient.

Morbidity, we believe, is a profitable and proper subject for review. Reviews and analyses offer a field that is limitless.

In closing, I may say that the staff conference committee has no rose-strewn path to walk on. They are the subject of criticism almost always, allegations being made that certain men are being favored or that certain men through the conference committee are excluded from conference for one reason or other. We have difficulties with the coterie which says that the whole thing is illegal; so that what we have accomplished in holding staff conferences has been done at the expenditure of a good deal of energy and by overcoming a great deal of criticism.

A MEMBER: A large number of hospitals review three things: the deaths, the unimproved cases, the infections, and the complications, each month.

DR. R. L. DICKINSON, New York: I would like to speak of the Woman's Hospital. Dr. Ward runs one of the best staff conferences I have seen. He begins with a brief presentation by the pathologist of interesting cases. Then he takes up the casualties, man by man. Each man at the head of a service is asked to report for his service, any deaths, any infections, any complications, and any errors in diagnosis. Then the follow-up is taken up, not each week, but once a month. Some interesting cases are taken up and the thing is a very live, keen, active meeting covering one hour.

Another of our excellent reviews is on a different basis. I refer now to Dr. Eugene Pool's conference in the New York hospital. It takes one hour, Friday, at 12, his whole staff being present. His conference is a little review of the staff itself. They have their pathology at a

separate time. They go over their X-ray work after lunch. They take up the errors of diagnosis, the follow-up work, and a general review once a month. They break up the meetings and that is very much better than running 3 hours on one afternoon or evening when everybody is tired out.

The great problem, I take it, is with hospitals open to many men. I recall one instance in a certain hospital—a doctor did not appear at a meeting, following the death of one of his patients. Before the following meeting he was notified, with a statement signed by the superintendent, that if he did not care enough for the service to obey the rules and come and report his casualty, his resignation would be welcomed.

5. *What is the best way to stimulate more consultations between members of the staff in hospitals?*

DR. JOHN SMITH, Philadelphia: Based on nearly 3 years experience with staff conferences, I would say that the answer to this question, how to stimulate more consultations between members of the staff in hospitals, is the clinical conference. What is needed is a feeling of kindliness and co-operation between the various members of the staff and various groups of specialists and there is only one way of doing that and that is through the clinical staff conference. I mean the general conferences as well as the group conference. The group conferences are important, but in order to get consultation you have to get a feeling of good-will and friendliness between the various groups, and a general staff conference is the only way to accomplish it.

In one hospital with which I was connected, up to 15 months before we started the staff conferences, consultations were really rare. We started the staff conferences and before long the men commenced to ask other men to come in and see their cases, and soon we had splendid statistics on consultations, and I believe that is really the only way that it can be done.

SECTION B—MEDICAL RECORDS

1. *Should not every medical man be responsible for seeing that a complete history is provided for each one of his cases, whether public or private?*

DR. M. T. MACEACHERN: I think the spirit of the question means that the physician either writes the record himself or sees that somebody writes it, and that it is of good quality and complete. First of all, let us have a show of hands. How many of you think that a doctor should be responsible for a complete history in the light that I have explained? (Vote taken—large majority in affirmative.)

DR. S. G. DAVIDSON, Superintendent, Rockford Hospital, Rockford, Illinois: On this subject of records in the hospital, should the doctor be responsible for the records? Of what value is the record to anyone except the doctor, primarily? So why should he not be responsible for it? Every man knows that the value of the record to him and his patient lies in the fact that he can go back to those records 1, 2, and 5 years, and study his cases and give his patients better service next year, and better service this year than last. If they are not responsible, who is?

MR. C. A. LINDBLAD, Superintendent, Buffalo Homeopathic Hospital, Buffalo, New York: I just want to give you a little experience on this subject. Our institution is an open hospital, but only reputable physicians, physicians approved by a committee, are given hospital privileges. I think that the great difficulty is that the average hospital superintendent is more or less afraid to ask the physicians to do a little work. Three months ago, shortly after I assumed charge of this institution, I wrote a personal letter to each man doing work in our hospital—and by the way, there are some seventy-five or eighty taking care of the private work—and asked each of the men sending a patient to the hospital to write his own histories or see that they were written. As soon as the patient is admitted to the hospital, the hospital statistician in charge of the record room prepares the history blank and mails it to the physician. This letter simply states that we would like to have him complete this preliminary personal history and the working diagnosis and return it promptly in the enclosed stamped envelope. This history can be prepared from his personal knowledge, by his office or clinical assistant, nurse in his office, or he can do it himself. This attempt was simply a try-out to see how it would work, and since we started this three months ago, we are getting 95 per cent of those histories returned to us in fairly good condition.

2. *What is the best way to secure operating-room records and what should they consist of mainly?*

DR. SIMON TANNENBAUM, Superintendent, Jewish Hospital, Philadelphia: This question naturally resolves itself into two headings, namely the records that are necessary or essential, and the method of obtaining those records.

If I were asked to say briefly what those records should consist of, I would say that the record should consist of everything relating to the

patient from the time he is taken from his bed for the operation to the time he is returned to his bed from the operation.

These records consist of three parts: first, what is known as the record of the operating room; second, the record of the anæsthesia; and third, the record of the operation.

Now, first, the record of the operating room is a big book which is usually kept in the operating room and consists of brief entries of the patient's name; his location in the hospital; the operation; the name of the surgeon, the name of the assistant and interne and also the name of the anæsthetist.

The record of the anæsthesia should consist of the record taken immediately beginning with the time the patient is removed from his bed, and should contain, first of all, the record of the pre-anæsthetic period—the pulse, respiration, temperature, blood pressure, and, as well, his general condition and the condition of his heart and lungs. Next, the stage of the anæsthesia; the kind of anæsthetic used; quantity used; the condition of the patient during the anæsthesia, giving fifteen-minute record of the pulse and respiration; then the conclusion of the anæsthesia, stating what the condition of the patient is, including his pulse, respiration, and temperature.

The next is the record of the operation itself. Now, it may be a record on a sheet by itself or it may be apart of the general history. That is a matter of choice. The record should contain the pre-operative diagnosis. That is one of the most important parts, perhaps the most important part, of the record. It should then contain a description of the operation, describing step by step, giving the source of pathology, the organs explored, stating whether they were normal or abnormal; the closure, what ligatures were used, and so on; and a most important record, not to be forgotten, is whether drainage is left in the patient.

Now, we come to the method of reporting the operation. That is a matter of choice. Some operators can dictate the operation during the operation itself. Some of our very best surgeons do. Others leave it until the operation is over. It should, however, be dictated immediately after operation, giving in detail, as I said before, every stage of the operation. It is dictated sometimes to the anæsthetist. It may be dictated to a stenographer who is there for that purpose. It may be dictated into a dictaphone, which does not require anybody's time and can be taken off at any time.

The question whether the report of the operation should be dictated by the surgeon himself or whether it should be dictated by the interne is one which is still open. The educational value of having the interne dictate the operation is apparent. If the interne dictates it and it is then read by the surgeon, the interne will certainly be benefited a great deal by it.

Accurate records will very strongly show the character of the surgical work performed in any hospital. It will stare the surgeon right in the face and will show him how often he has been mistaken in his diagnosis and how often he has been right. And that is the kind of record I believe should be found in every hospital.

Dr. M. T. MacEachern: I think Mr. Tannenbaum has covered the subject very fully. On the method of reporting the operation, he gives us, first, the stenographer; next, the dictaphone; and last, the surgeon writing it. The most satisfactory seems to be dictation to a good stenographer.

3. *What is the best procedure to keep accurate records of all postoperative infections?*

Mr. James U. Norris, Superintendent, Woman's Hospital, New York: At the Woman's Hospital, we have a record form of a distinctive color and on it is recorded every dressing from the time of operation, name of Doctor removing drain, number of sutures, wound healing, the promptness of union, condition of wound on discharge, list of dressings, and character of dressing. That is part of every history.

4. *Who should be responsible for overseeing of the medical records as to completeness and quality?*

Dr. F. L. Adair, Chief of Staff, Swedish Hospital, Minneapolis, Minnesota: A question of responsibility is involved in the answer to this question. And it seems to me that we should recognize responsibility of two kinds: First, the collective responsibility of the hospital to the community as a whole. This involves the medical personnel, the nursing personnel, and every individual engaged in carrying out the proper functions of a hospital. The individual responsibility of the physician to the patient cannot be taken over by the hospital, nor can the collective responsibility of the institution be taken over by the physician. It may be assumed largely that both the institution and the physician are responsible for the completeness and quality of these records. The keeping and preserving the records is easily the function of the administrator of the hospital, and can quite readily be taken care of by somebody. It is merely checking of the different sheets, to see that they are present in the record before the record is filed away. Administration is also re-

sponsible for the enforcement of this, because it is responsible to the public for the maintenance of these records as one of its functions and obligations to the community.

The accuracy of the records cannot possibly be checked by the administrator nor by the historian, or record clerk, whatever she may be called. That must be up to the individual medical men. No one else can be responsible for the accuracy of the records. And it is better probably not to have any records than to have inaccurate records. Of course, a certain amount of inaccuracies will creep in, but on the whole, if records cannot be depended upon for accuracy, they are worse than useless.

The attending man or the visiting man who is responsible for the care of the individual patient must either supply the record from direct contact and direct history and examination of the patient or he must do it by proxy through a member of the house staff. Either one of these might work out differently in different institutions. In the last analysis, the enforcement of the accuracy of the record is not up to the hospital administrator but to the staff, because medical men are the only ones competent to pass upon the fundamental accuracy of these records. This is done, as has been pointed out, through these monthly conferences, where the records are subjected to the scrutiny of medical men.

There is another point and that is the duplication of records where the physician keeps in his office complete records of the case, as any up-to-date medical man should, and when the patient goes to the hospital, a record of the case should remain in the hospital. This involves a certain duplication of effort and the cost of it comes back on the physician or the community, as the case may be. It seems to me that the logical ultimate solution of this question is through a closer association of physicians with hospitals, so that the institution and the physician's office ultimately become consolidated, so that, instead of duplicating records there is finally only one record and the work of the medical man becomes identified with the institution. It seems to me that that is at least one logical conclusion of this problem.

Dr. W. A. Hausman, Jr., Allentown, Pennsylvania: I think it would be easier to bring about the writing of records if a rule were made that all cases must have their records complete before the patient can be operated upon. The provisional diagnosis must be made at the time of the examination of the patient and those records must be completed before the patient is operated upon.

As to the question which is up at the present time, at the Sacred Heart Hospital we have made it a custom for the chiefs of the departments to O.K. records at the completion of the case and each one of the records is gone over to see whether the record is there in its entirety. We pay no attention to small errors or differences in diagnosis or things of that kind at the time, the aim being to see whether that record is complete or not. The chief of the department goes over the same and passes it if it is correctly filled out. If not, it is passed back and is not filed and is placed among the incomplete records until such time as it is corrected by the surgeon in charge.

Dr. G. E. Follansbee, Cleveland, Ohio: I cannot agree with what the speaker has said about the responsibility for the record. Theoretically he is right but practically I believe he is wrong. A man's conscience in a great majority of cases in the hospital staff is not a sufficient club to make him give you a complete, accurate, and truthful record. He may make his record complete, but I will question a great many of the records in a hospital as to their truthfulness unless those records are carefully gone over and minutely inspected with a suspicious eye by a competent record keeper or a man familiar with records.

This matter has come to my attention before and I have been somewhat interested in looking over the records in hospitals to see how well those records were kept, and I am sorry to say that in some hospitals, with apparently satisfactory records, careful investigation revealed very untruthful records. I believe that the responsibility of a correct record belongs in the hospital and that there should be some one in the hospital, preferably connected with the staff and interested in the matter of records, a sub-officer of records, whose duty it shall be to go over those records with a fine-toothed comb. If we do that and then untruthful or unsatisfactory records are brought up, we can get records that are of some value. But of what value, I would like to ask you, is an untruthful record in any hospital. You are better off without a record than to have an untruthful record.

Dr. Edward A. Weiss, Pittsburgh, Pennsylvania: We have found that the most satisfactory method of proving the record as to correctness and completeness is to have a committee of three from the staff. Each man takes 2 hours a week and goes over the records in the record room and approves them if correct and then they are filed. If incorrect or deficient in any respect, a note is made on that record and the individual member of the staff to whom the case belongs is

then called to the record room and required to complete it. If a blood count, for example, has not been made, he is required to write on that record why this was omitted, etc. This committee serves for 3 months only and then three other members of the staff are appointed. No member of the committee is permitted to pass on one of his own records. This has worked very satisfactorily with us.

DR. E. A. SOMMER, Portland, Oregon: I believe that the hospital ought to furnish a stenographer to take the record of the operation and place it on the history and then allow the surgeon to O.K. it.

SECTION C—LABORATORIES

1. *What laboratory work should a hospital of 75 to 100 beds provide as a minimum service?*

DR. M. T. MACEACHERN: To expedite matters I have distributed a little pamphlet covering this subject (sent on request).

2. *A hospital wants a routine pathological service in connection with their surgery. How can such a service be financed?*

DR. S. G. DAVIDSON, Superintendent, Rockford Hospital, Rockford, Illinois: How can such a service be financed? That is the main question. We had that up this morning—the cost of the work. It was just brought up that we should have a stenographer in the operating room.

Laboratory work is admittedly one of the most essential in our hospital service. And how can it be financed? Just how much laboratory work do the attending men want? What laboratory service should a hospital of 75 to 100 beds provide as a minimum standard? Why, you want the best, do you not? You want everything you can have, don't you? And you want the tests made by the most competent laboratory people.

To answer the question, you have to group your hospitals into two groups: the hospital in the small community and the small hospital in the large community where there are a number of other larger hospitals.

In the small community, if the attending men in the hospitals or in that community will make proper use of the laboratory it is going to multiply its service over and over again every single month and there can be no question about financing it. Unfortunately, it becomes necessary for every hospital superintendent, when he has established a first-class laboratory, to begin to educate his attending men to make use of that laboratory. I just had the pleasure this year of installing a laboratory in a hospital of one hundred beds in a community of seventy thousand people with two other hospitals, all small. I think that is one of the crying disgraces—three small hospitals in a community of seventy thousand, with all their overhead, with all their mismanagement, when any one hospital with the same number of beds could take care of all those patients and do it so much better.

We installed a laboratory costing one thousand, five hundred and eighty-eight dollars, equipment enough to take care of a hospital of three hundred beds or more, and we employed an excellent pathologist. We are paying him thirty-five hundred dollars a year and 50 per cent of the net profits. Some of the medical profession felt that a pathologist was not worth more than from twenty-three hundred to five thousand dollars. At those figures we cannot expect men to take up that work. But when the medical men begin to wake up to the fact that that is one of the most important services we have, they will begin to pay pathologists seven, eight, or nine thousand dollars a year. And then you are going to have good work done. We feel that our man would be able to earn at least six thousand dollars a year. How do we finance it? We take the cost of the operation of that laboratory, pro-rate it over our bed charges, and add 50 cents a day. This enables us to give all the laboratory service that the attending men ask for, routine analysis and so forth, anything that he wants is done and as much of it as is wanted. They do not have to ask the patient or tell him it is going to cost more. We figure on a basis of 30 per cent, which means 50 per cent for your smaller hospitals of 40 or 50 beds.

3. *How many hospitals are routinely putting through all the material removed in the operating room and thus checking up diagnoses?*

DR. M. T. MACEACHERN: This calls for a show of hands. (Vote taken.) I am glad there are so many.

Right here I want to tell you, you who are building new hospitals, do not forget to put your laboratory next to your operating room and your operating room where your pathologist is at your surgeon's elbow. We have proved its value.

4. *How can the pathologist arouse more interest in the clinicians and internes along laboratory lines?*

DR. A. K. HAYWOOD, Montreal: There evidently must have been some reason for putting this question on the program and the reason is that the pathologist must arouse more interest

in the clinician and in the interne. If you will show me a hospital that is popular, doing up-to-date work, I will show you a hospital that has a keen pathologist. The pathologist must have a keen interest in the clinician. He must be able to come and decide with the clinician, not in a spirit of criticism but as a consultant, in a spirit of helpfulness, and if you will apply that, you will find that in practically every obscure case your pathologist can be of inestimable value to the clinician. He doesn't examine merely for his own interest or for any financial gain. He examines more and more in his laboratory in order that he may be able to render some service to the patient. He must be confidential, he must be kindly disposed, his criticism should be softened with a certain amount of patience, he must make the interne welcome when he comes into the laboratory. If he is going to arouse interest, he must make them feel welcome at all times to come into his laboratory and chat over obscure or ordinary cases. The pathologist's laboratory is a source of supply for many interesting discussions. It does not matter where the laboratory is situated, if the pathologist is a keen, tactful fellow-being, he will attract the interne and the clinician to his laboratory. In clinical pathological conferences, the pathologist in many cases acts as judge and jury. He can commend and he can criticize, and it is only reasonable, when mistakes in diagnosis have been made and it is necessary for the pathologist to draw the attention of the attending men to them, that he should do that in a manner that is not offensive.

All diagnoses should be made on every case in black and white and put down on the history and the pathologist should insist that the history gets to the postmortem room.

A pathologist will very often forget that he is talking to students and to internes. He must be very guarded so as not to talk over their heads. If the clinicians and internes have implicit confidence in the pathologist, if he is a tactful and kindly pathologist, I do not think that he will have very much difficulty in interesting the clinicians or the internes in laboratory methods.

DR. MACEACHERN: Dr. Haywood brought out two points, the sending in of the various diagnoses by the clinicians and internes to the postmortem room, and second, the pathological staff conference. On my way here, I attended for a few minutes one of the conferences referred to, at which the internes and the different members of the surgical service met the pathologist. They meet every Friday morning to discuss the pathology of the week.

A MEMBER: I know a great many pathologists and I know that they differ just about as much as do clinicians. So I believe that the only way to arrive at any conclusion is by hearty co-operation between the pathologist and the clinician. Take any tissue that is removed. We have all had experience. We send it to the laboratory and get a report. Send it to another laboratory and you will get a different report. One of them is wrong. Let us not lose track of this. And let us remember that the laboratory and the clinician must work together.

SECTION D—NURSING

1. *Can a hospital attain the minimum standard with what is considered an incompetent nursing staff?*

DR. CHARLES H. MAYO, Rochester, Minnesota: We are all interested in the care of the sick which has been greatly changed from ancient customs. The modern methods, proved to be the best, are now accepted by the public. It is only a few decades since hospitals, some in truth hotbeds of infection, were looked on as places to die in, a place of refuge especially for the poor. They are now sought by the intelligent sick who desire the best possible care. No one factor has brought about this revolutionary change. The better knowledge concerning disease and its transmission and prevention, of the educated public who now demand more of the physician, has probably been the greatest factor in bringing about the reorganization: the development of public education in hygiene will be the next great factor.

The trained nurse has given nursing the human, or shall we say, the divine touch, and made the hospital desirable for patients with serious ailments regardless of their home advantages. The rich patient who can pay the price, the poor patient who can pay nothing, may secure the highest service in sickness. But how about the larger group of patients in the middle class, who neither rich nor poor, would be glad to preserve their self-respect by paying to the limit of their ability? The key-note of hospital efficiency today or of any other great movement depending on combined effort is organization. So few hospitals pay their expenses that, like educational institutions, unless they are supported from a bequest, they must be assisted by charity or by the city, state, or some religious or similar organization to make up the yearly deficit. Can a hospital give the minimum standard of care without the most efficient help? The answer is "no" as opposed to public service and the support of

standards of efficiency. Yet, if the hospitals have competent physicians, surgeons, internes, superintendents, and trained chiefs of nurses with intelligent and willing undergraduates much can be accomplished to attain the minimum standard in a comparatively short time. The nursing and care of the sick is a matter of education, and ignorance may be overcome. Knowledge is acquired by a compelling force from within, by desire, or from without, by compulsion. No matter how efficient in general the nursing staff is, the hospital will not be safe and truly serve the best interests of the sick without supervision by some one in authority. This cannot be reversed; the most competent nursing staff cannot replace those who are responsible for the direction or the administration of the organization.

What can be done to maintain the efficiency and save the professional life and dignity of our nurses; can we help them to help themselves? They are compelled to study and labor diligently for 3 years after having achieved a high standard of general education. They are overtrained for nurses and undertrained for physicians. It is true that the training is good for them; the greater number marry, and the wide general knowledge they have acquired is, in fact, of more value to them, their children, and the communities in which they live, than are college degrees, as it contributes to better national health and a more practical citizenship. The records of St. Mary's Hospital in Rochester show that of the nurses graduating for the ten years preceding the last three years, 1 per cent are dead, and 54 per cent are married. Of the class of four years ago, 31 per cent are married. If, then, excluding the last three-year graduates, 2 per cent are out of the work, only 43 per cent are left in the service of the previous ten-year period that has taken the nurses three years of hard, continuous study and work to learn, as long in actual time spent as it takes to study medicine and three to four times as long as it takes to acquire a degree as osteopath or chiropractor. It is evident that the foundation requirements are too high for the average demand, and in all fairness must be made a little higher by specialization, and by giving added responsibilities in positions as technical assistants, or the period of training must be shorter in conformity with requirements for ordinary nursing duty in order that a greater number may obtain the benefit of this educational training.

The course of training should be two years with post-graduate study for the third year, which should be optional, and it should be possible to take it at any time desired, so that those who remain in the work may fit themselves for the work in which there is greater opportunity for service and securing personal distinction. Chief nurse in the hospital, chief surgical nurse, nurse in dressing service, anæsthetist, county, city and school nurse, industrial and child welfare nurse, dentist's aid, physician's aid, and laboratory technician, are but a few of the many positions waiting. It is far from my desire to destroy nursing standards; on the contrary, I wish to advance them for those who remain in the profession with a demand for recognition of ability, responsibility, and honor which will then be accorded.

The patient sends for the physician first. The physician secures a nurse if desired, or he sends the patient to the hospital where a nurse in rotation is assigned by the superintendent. The physician or surgeon must assume the responsibility, even though death occurs from an accident in crae.

Any labor union in which the candidate draws pay or receives only board and lodging while in training, as does the bricklayer, plumber, and carpenter, protects the job by limiting the number of apprentices. In professional life there is some danger in over-organization. The nurse, in accepting unionism, must carefully watch the policies of the organization that they be maintained along professional lines with their legislative efforts directed unselfishly to better care of the sick. As a physician, I am proud that legislative acts sponsored by them, with the one exception of that sponsored by medical anæsthetists, have always been in the interest of public health without thought of advantage to the profession. The physicians' services are always at command for charity, which service the nurse cannot give.

In the interests of the sick I strongly advocate a return to the two-year course as a minimum standard of nurses' training and the development of post-graduate work with a special diploma for advance training. In urging this, I wish to call attention to the fact that in the Great War the medical department under the surgeon-general was developed to the highest efficiency by the valuable aid of the leaders of the department of nurses in Washington, and in the service abroad and at home. Most of the leaders in this group were themselves two-year graduates, thoroughly capable and most devoted to their work.

It has been suggested that those who possess a high-school certificate should be graduated in two years from a course in general nursing, and those desiring training in special branches continue or take such training at a later period. In some

progressive cities, such as Minneapolis, the theory of nursing with the fundamental branches is now given as a vocational training course with 6 months of practical work in a convalescent hospital in the public school system.

2. *Should not all undergraduate nursing service, including especially operating-room and maternity technique, be supervised by competent and experienced graduate nurses?*

Miss C. Lillian Clayton, Director of Nurses, Bureau of Hospitals, Department of Health, Philadelphia, Pennsylvania: Answering Dr. MacEachern's question from the standpoint of the general subject of this afternoon's discussion, my answer should be in the affirmative. Undergraduate nurses should have competent and experienced graduate supervision both from the standpoint of improving the professional work in the hospital apart from the patient and because it provides better service to the patient.

To secure adequate graduate nurse supervision is one of the most important steps in efficient hospital administration. Supervision of undergraduate nurses means much more than the words superficially imply. It means the establishing and maintaining of proper professional relationships between the administration and those supervised, with the patients, the medical service, and all departments related to the wards.

To do this successfully requires tact, ability, education, and experience not possessed by the undergraduate. The value of our nursing service is in large part due to this group of workers. The value of the supervisor lies in her understanding of her own work.

Supervision does not mean interference with those supervised. It does mean, however, that the needs of those supervised most be understood and properly met. These needs are met because the supervisor's own previous education and experience have given her the proper background and her personality makes it possible for her to meet the needs of those supervised because of her own knowledge. In this manner she makes the value of the student greater.

First, because she teaches her accurately to understand the work of the individual in relation to the work as a whole.

Second, because her previous education and experience have made it possible for her to solve problems successfully, she commands the respect of the students and as a result of this the student learns to solve problems for herself. She is not afraid. She does not evade difficult tasks by transferring them to others, or by leaving them undone.

The student enters her work with much interest and youthful enthusiasm. This is priceless to the patient, to the hospital, to society, and to the nurse herself. It must not be lost. It will be lost, however, if she is not taught to use this interest and enthusiasm in the development of herself in her service. One of the great duties of the supervisor is to direct these qualities into the proper avenues of self-expression.

The supervisors form the necessary connecting link between the instruction received in the class room and its application at the bedside of the patient: between hospital administration and co-operation, "between medical science and its actual application when related to the patient." In other words, a supervisor is a teacher who helps. She is the connecting link between science and art; she keeps the balance between theory and practice.

3. *Nurses' records on patients in many instances are useless. What are the essentials of such records, and how can they be made of greater use?*

Miss Katherine Tucker, Superintendent, Visiting Nurse Society of Philadelphia: Certainly there can be little difference of opinion as to the fact that most nurses' records are useless, and therefore the real point of interest is why they are useless and what can be done about it. Too often the records are an expression of the opinions of the nurse and not an accurate statement of her observation of objective facts. Furthermore, the facts noted are the least essential while the truly significant ones may be given a superficial and inadequate description. For instance, the mere statement that a patient had a pain in his side or suffered from a chill leaves unnoted the really important point as to the exact place and nature of the pain and the kind of chill.

Granting the unsatisfactoriness of the present situation, what are the elements considered essential for a complete nurse's record? We can rather take for granted the clinical chart which gives a graphic presentation of the temperature, pulse, and respiration, with a numerical statement of the output and intake, details and description of which should appear in the nurse's notes. The important question, therefore, is what the notes should contain. These should give an accurate description of the patient's objective symptoms with a definite statement of the exact treatment given by the nurse and the patient's responses to such treatment. They should also include a brief statement of other occurrences that might affect the patient's condition. These statements should

not be matters of opinion but a careful description of facts.

Such records will not be easy to procure as nurses as a rule are not articulate in words, being chiefly expressive through their hands. It is necessary therefore to consider whether it is important to have such records and if so, how they can be acquired. They really are of primary importance to the patient as they assure him of the most careful consideration of all that might have bearing on his case. They should be essential to the doctor as developments might occur during his absence of which he cannot be aware except through the nurse's written record. She herself might not remember each significant detail unless she wrote it down. Furthermore, they are of importance to the doctor as a memorandum for future reference. The nurse also would benefit largely from such records as it would increase her interest in the patient and give added importance to her care of each case which would tend to make her more observant and have a tremendous educational value, helping her to correlate theory and practice, thus giving her a more intelligent understanding of her case. If these records are kept as described they should have a scientific value that cannot be overlooked and would contribute to the sum total of our knowledge of disease.

The real question is whether such records can be procured. To my mind the answer is that they can and should be procured; this, however, presupposes a broad foundation. No nurse could keep such records unless she were possessed of a fundamental intelligence and a sound preliminary education, preferably 4 years of high school. Added to this she must have a scientific knowledge which will teach her how to observe. This in turn involves sound teaching during her nursing training. In other words, the whole question of accurate nurses' records which are the right of the patient and should be a necessity to the doctor goes back to the type of woman we must get into our training schools and the kind of teaching we give her when she is there.

4. *What constitutes competent and sound applied nursing service in our hospitals today?*

Miss Mary M. Riddle, Superintendent, Newton Hospital, Newton Lower Falls, Massachusetts: One might say, that nursing service which helps the patients back to normal physical conditions and insures their ability to continue the ordinary pursuits of life and promote their happiness as well as general welfare, must be the soundest applied nursing service our hospitals can furnish today. And that hospital which recognizes these great obligations will lose no opportunity for acquiring equipment, knowledge, and the spirit to render it. Whether the nursing service is given by thoroughly trained and accomplished nurses or by a school of nursing which is an integral part of the hospital, it must be competent or the hospital does not meet its obligation to the patient. When the hospital is dependent upon its school of nursing for all or nearly all of the nursing care given to its inmates, it becomes necessary that the school shall have thorough instruction and competent supervision. If all other things were equal, one would say, or at least naturally suppose, that the best instruction would be given in the largest general hospitals. But since they are not equal, the best instruction is not always given there, though the material for teaching purposes is most abundant.

If the nursing body is accomplished and if the morale is what it should be, if there is enthusiasm for the work, conscientiousness in doing it, and a spirit of humanitarianism manifested or at least possessed by the nurse caring for the patient, whether the nursing service is rendered by pupils or graduates, it must pass into good care. In those institutions where the nursing care has always been given mainly by the pupils or a school of nursing, it has been the custom formerly to expect the most inexperienced beginners to undertake even complex work for the patients, who from the nature of their illness, should have had tender and skilful care and management. All that is now changed, it being the custom in those same schools to have the nurses made familiar with such procedures in the class room before coming in contact with the patients. This change is one of the blessings that have come out of the three years' course, advocates of which believe that practices should be so often repeated as to be done automatically and almost perfectly before the patient is subjected to them, and not only is a patient's comfort an item for consideration in this connection but his safety also, for when the nurse's routine practice is so nearly perfect, she need not concentrate her attention upon it but can keep her mind constantly upon the patient and his condition and thus often protect him from extreme weariness or even a much more serious situation that would really pass unnoticed if she were absorbed by her practice.

The patient should be given the best possible care at the hospital because, first, he needs it, and second, because the hospital by becoming such has positively agreed to give it. So far as the individ-

ual patient is concerned, the purpose is that he may be cured. But so far as the physicians, internes, and student nurses are concerned, there is an additional reason. That is, giving the care as thoroughly and scientifically as possible in order that other patients, future generations of patients anywhere and everywhere, may also have the benefit of their work. Besides the duty of the hospital in furnishing means for the possible cure of its patients, there is another duty it owes the public, and it may be classed under the head of prevention of the spread of disease. To this end it must then so use and suit the materials found in its walls that it can make its contribution to the sick. No small part of the additional work incurred in these procedures necessarily falls upon the nursing staff and it must be prepared for its work by being given suitable instruction. Here, again, may be mentioned another reason for the existence of the three years' course in the training school for nurses since suitable instruction in this as in all other forms of education requires time.

The arousing of the hospital and its staff through the hospital standardization campaign has borne much fruit, and that such efforts at improvement will have a stimulating effect upon the body of graduate nurses and nurse schools in all such institutions is firmly believed. Especially will it be so in those institutions where the student body of nurses is given recognition as an educational factor and where the school is supported, as it should be, by the hospital staff and community and standardization committee, all for the betterment of the sick.

It is believed, to recapitulate, that nursing service is best which contributes most to the ultimate recovery of the patient or, when recovery is impossible, which finds the patient every available comfort. It is believed that the most satisfactory nursing is done in the larger general hospitals and in those of secondary size by students of a well-equipped, well-managed, and well-instructed school of nurses. The old hospital slogan that "Nurses are created for the patients," must be amended to read, "for these and future patients, anywhere and everywhere, as well as for those whom we can help to avoid being patients." The nurses, therefore, must be trained to meet all such requirements, and 3 years are none too long for the purpose. It is the duty of the hospital to see that the student nurses get a just return for their efforts in its behalf. It is the nurse's duty, as well as privilege, to give her very best service to the patients and to carry out zealously all orders or directions for their care and treatment. If standardization does as much for the schools of nursing as it has done for the hospitals, it will certainly be welcomed by the schools.

The greatest need in the suffering world today is for young women of good breeding, of good education, and of fixed principles of righteousness, which when added to good training will make an army that will be invincible before selfishness, negligence, and profiteering.

Let the hospitals give them what they seek. Let the community give them a place in it. Let them be honored, let them be crowned with honor, and the dearth of them will disappear.